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WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

JUNE 30, 1960
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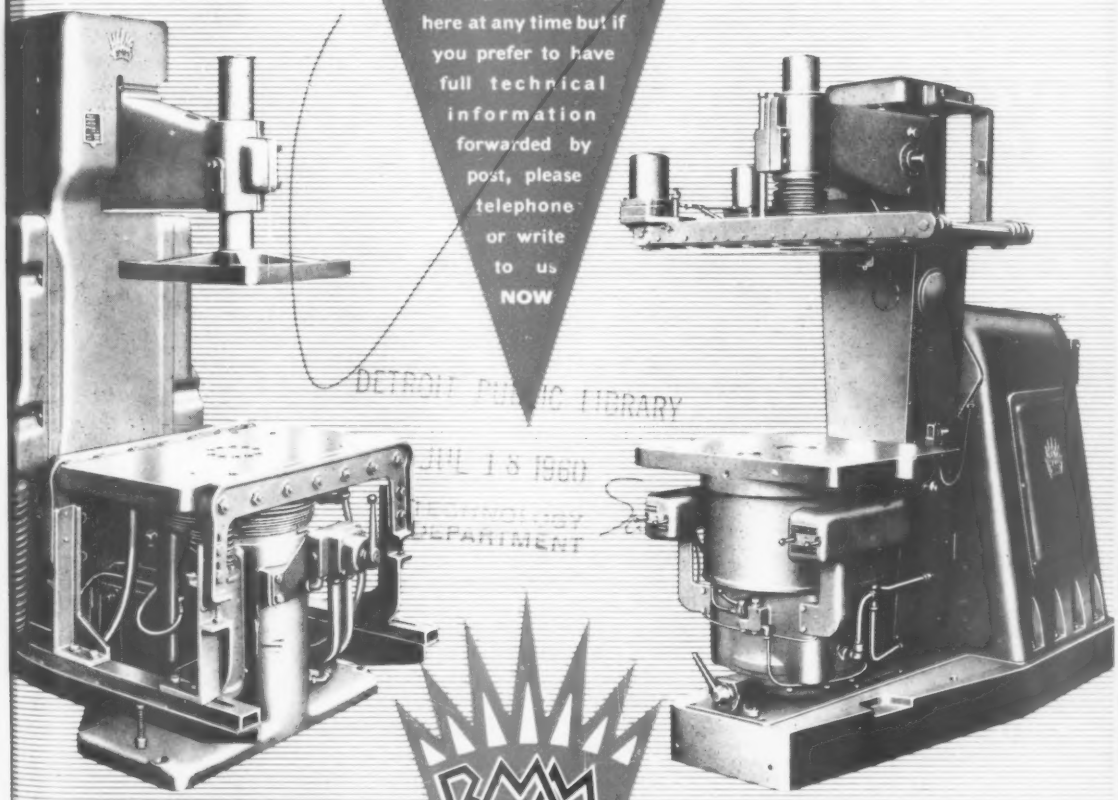

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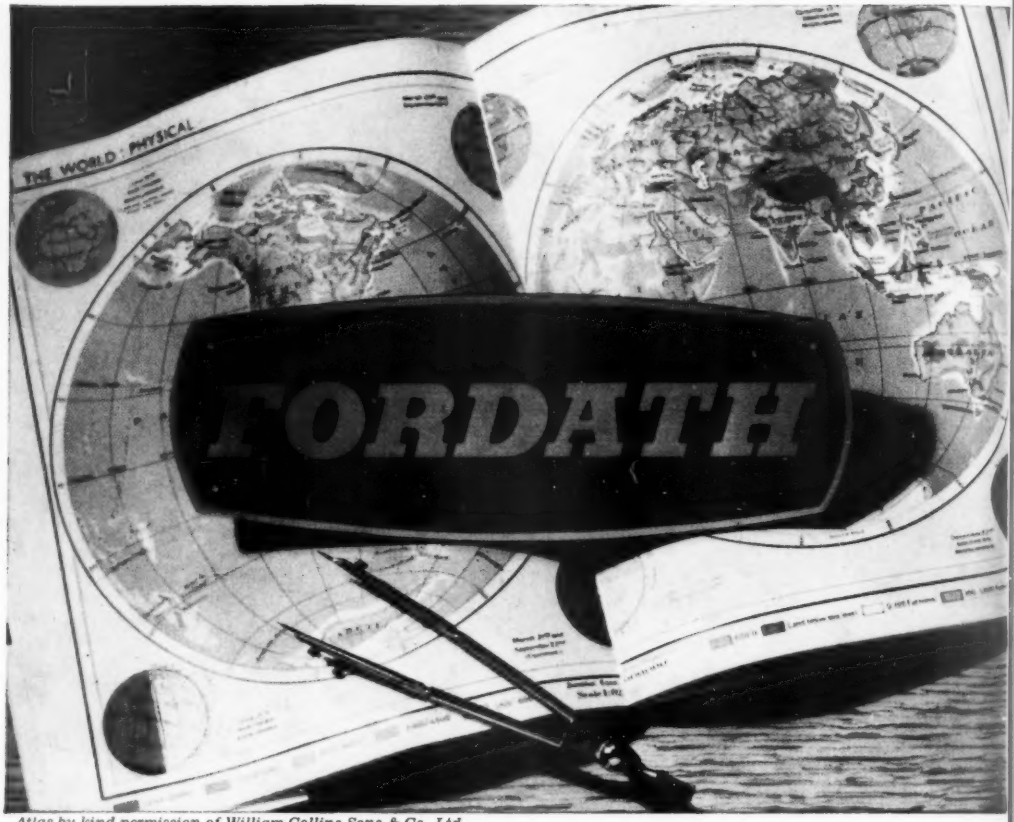

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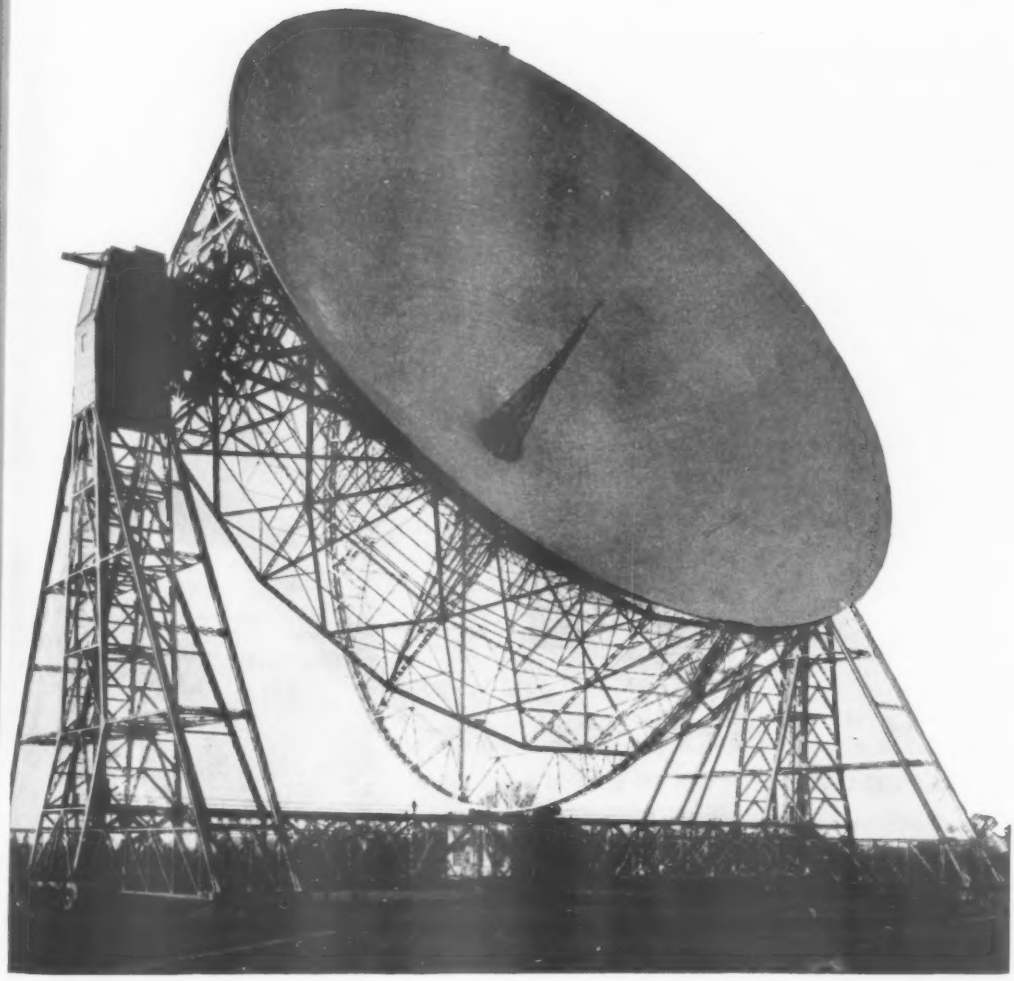

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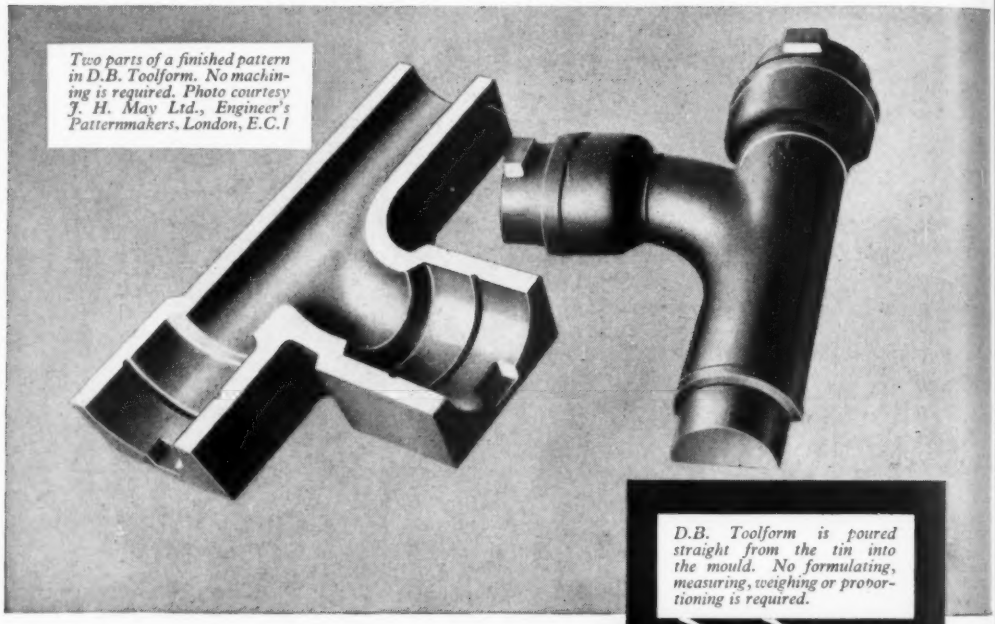

Two parts of a finished pattern in D.B. Toolform. No machining is required. Photo courtesy J. H. May Ltd., Engineer's Patternmakers, London, E.C.1

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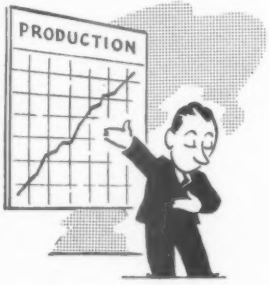

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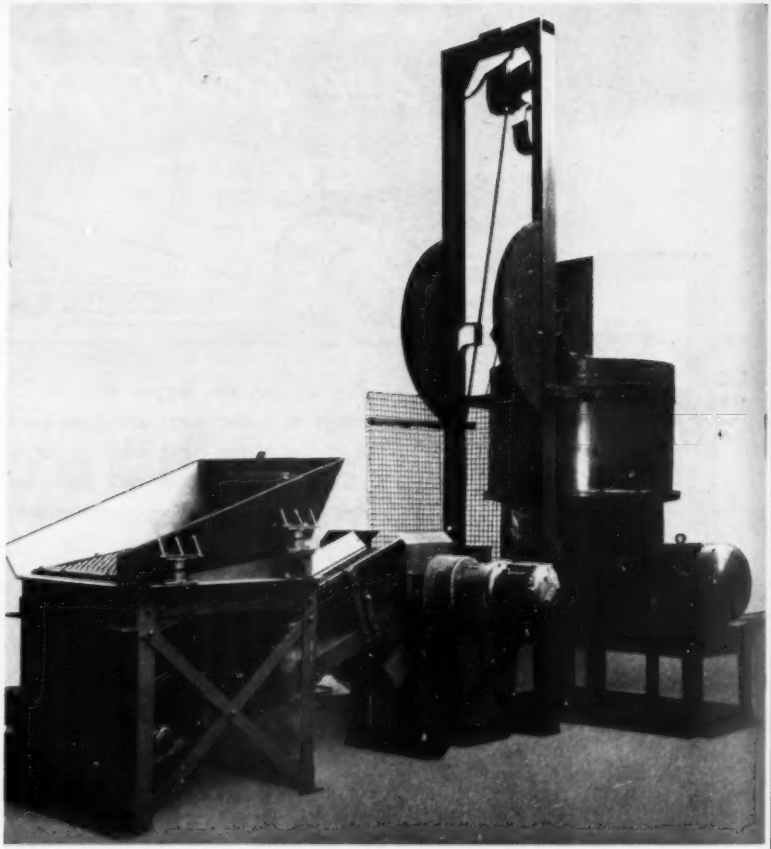

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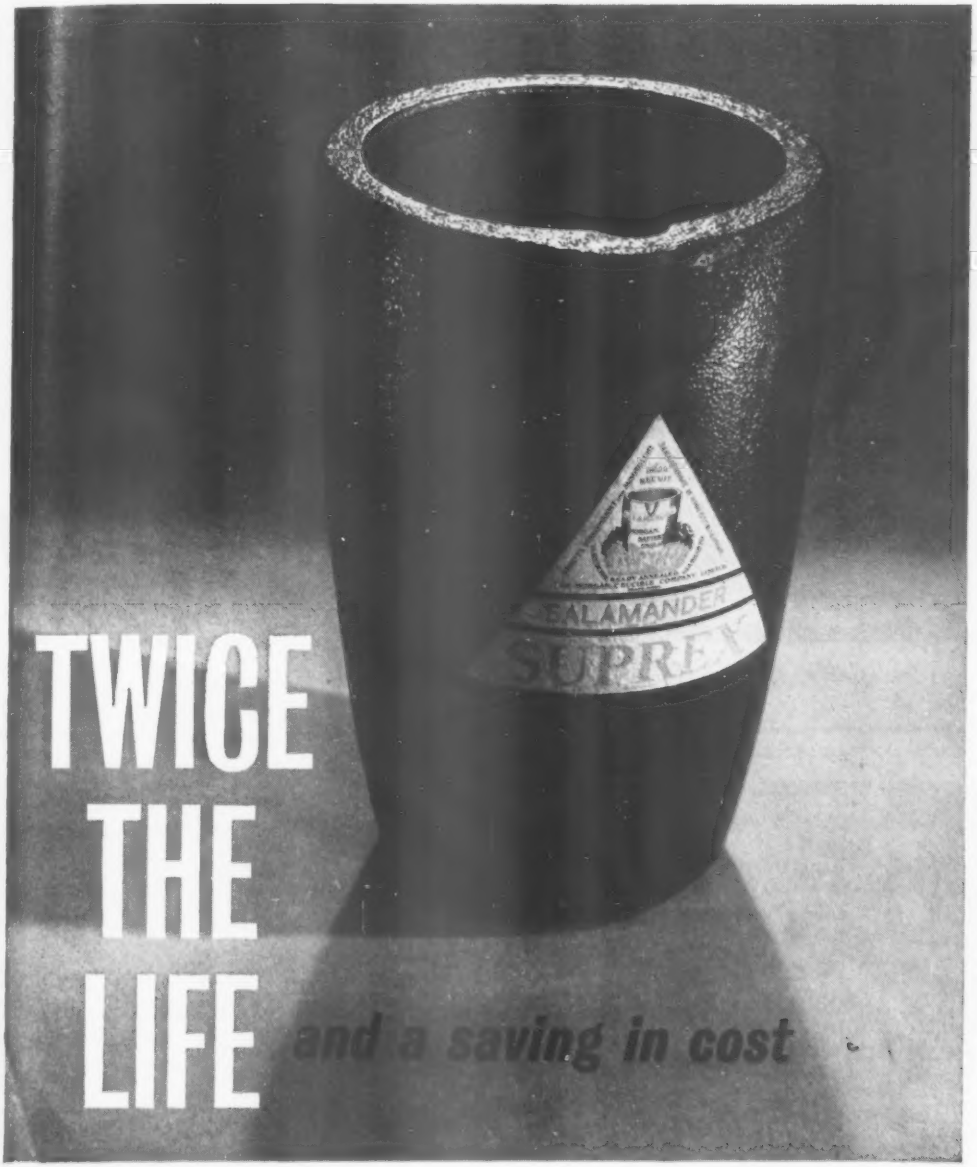

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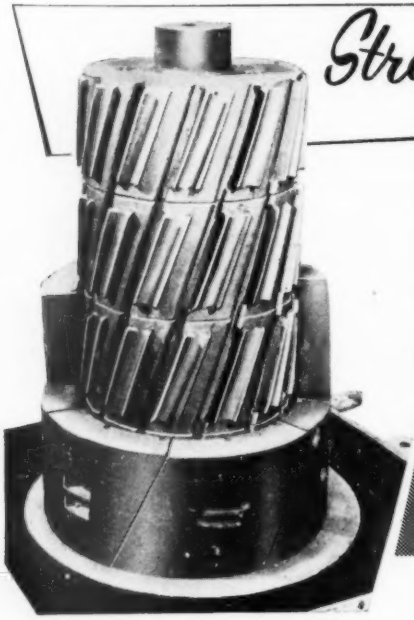

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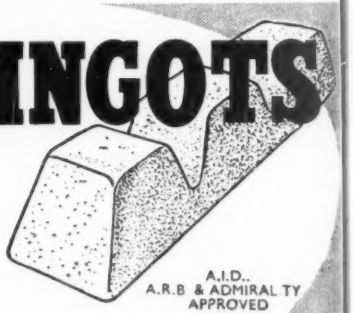

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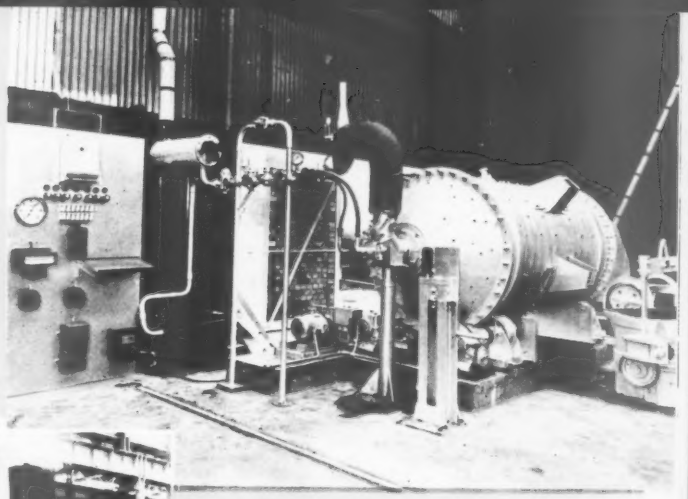

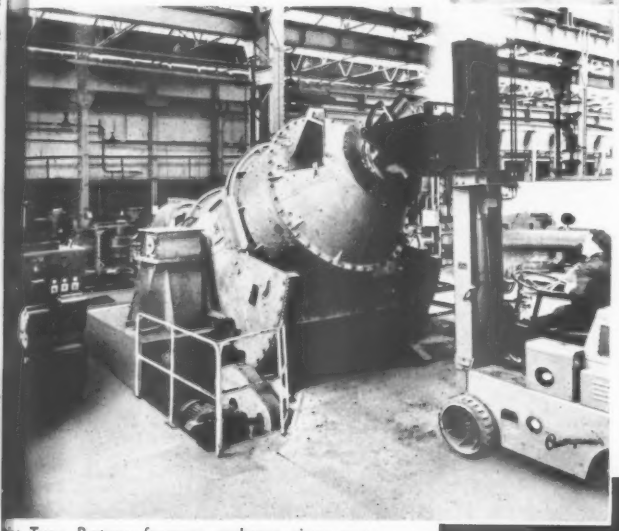

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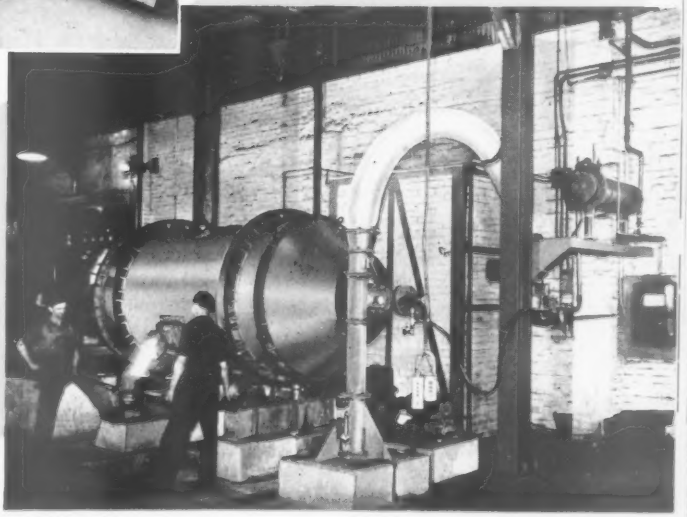

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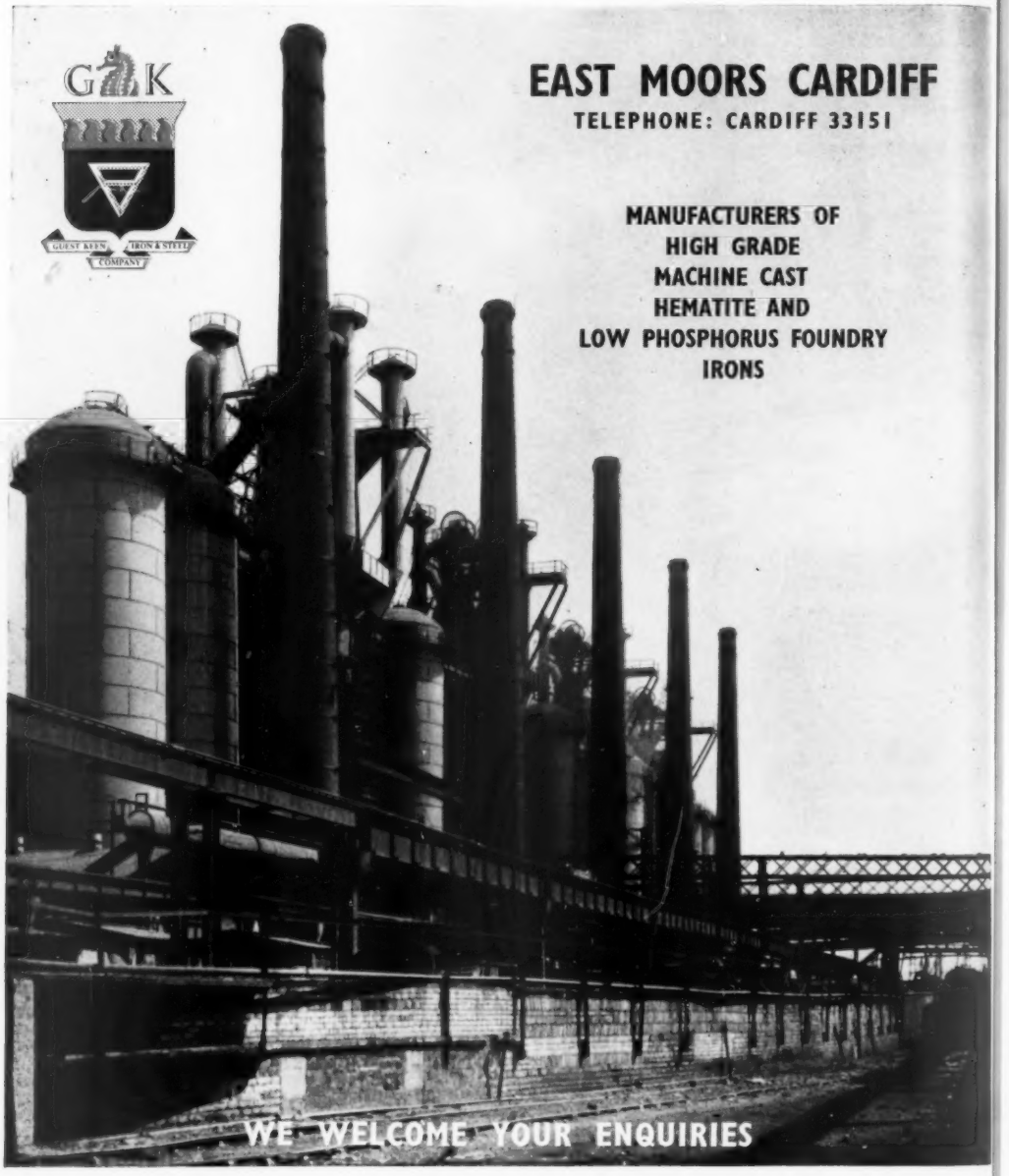

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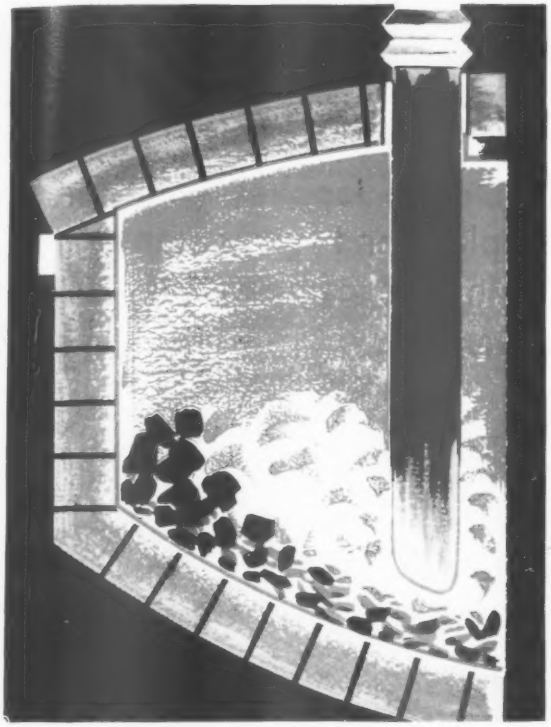

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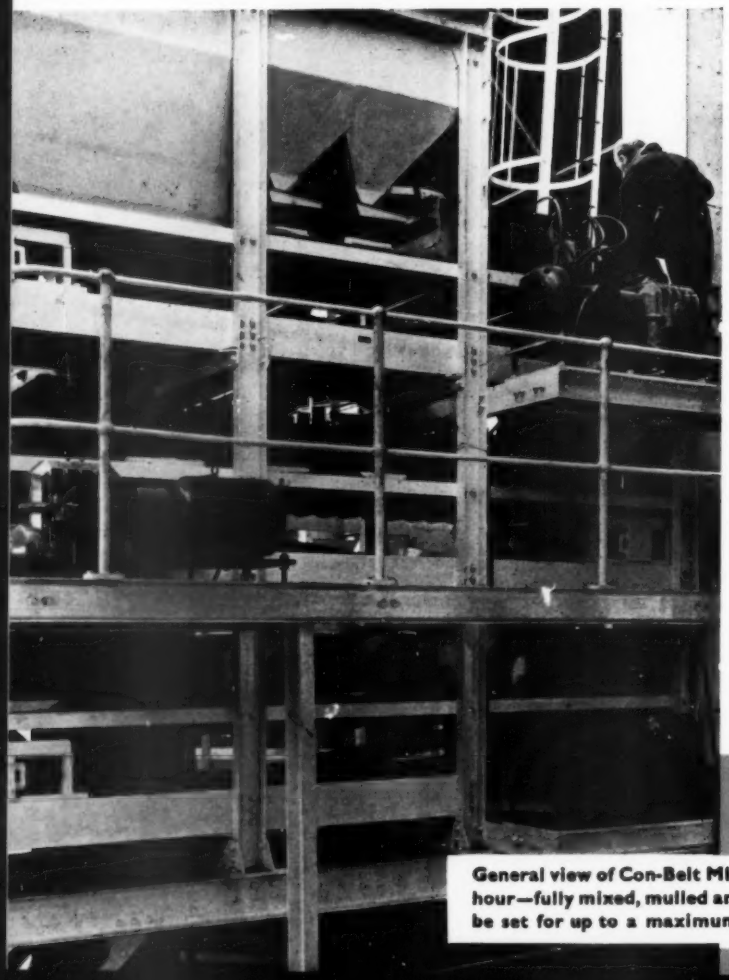

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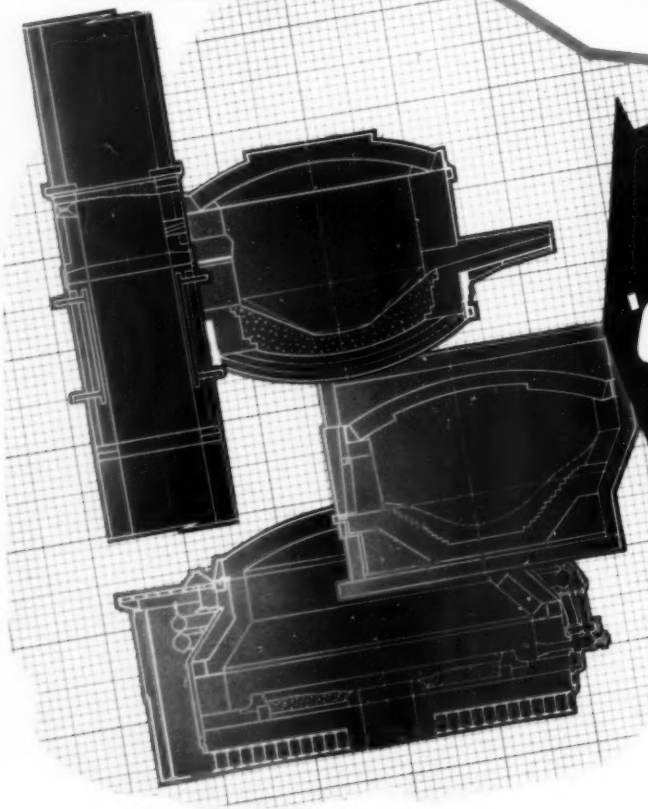

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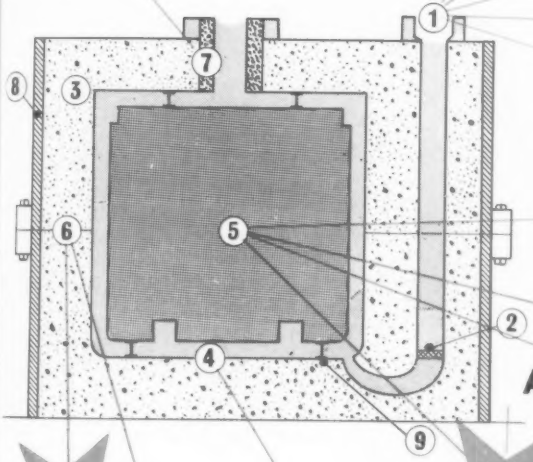

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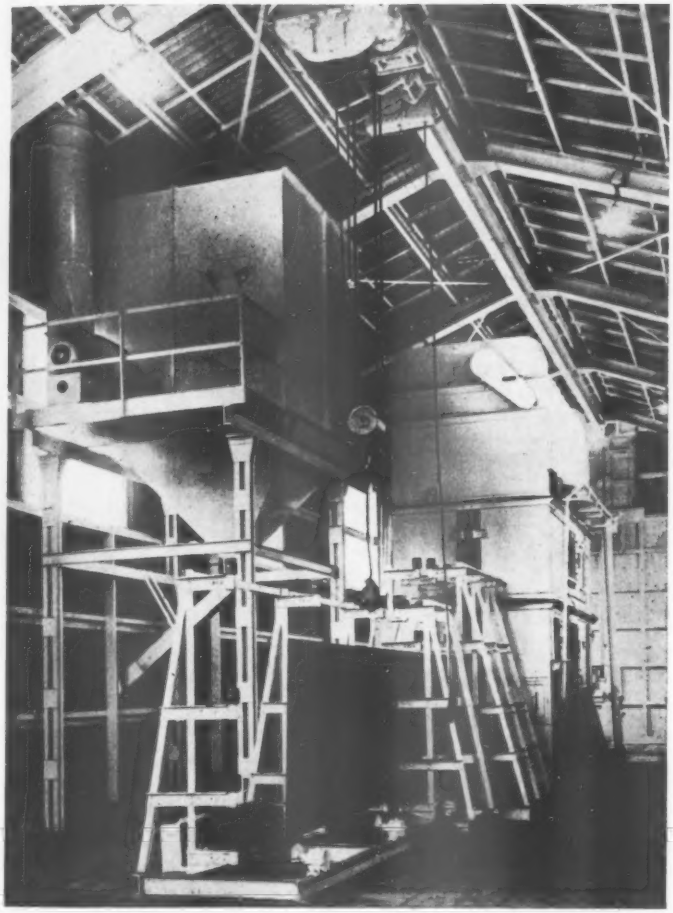

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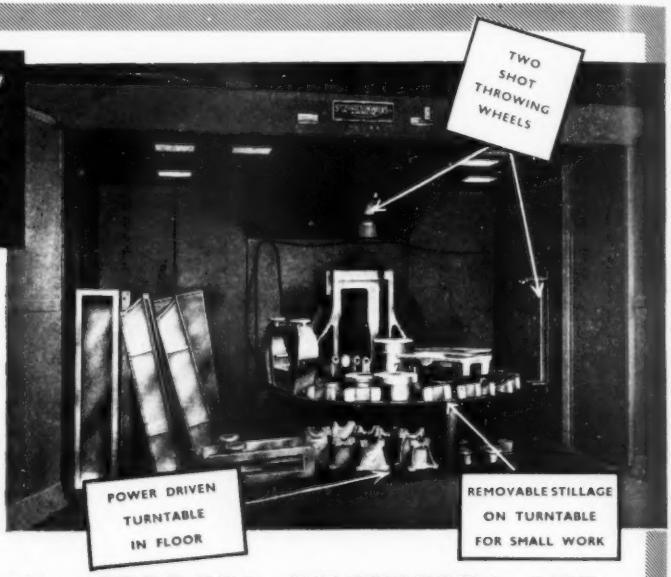

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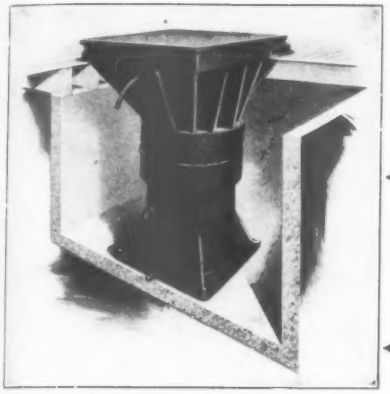

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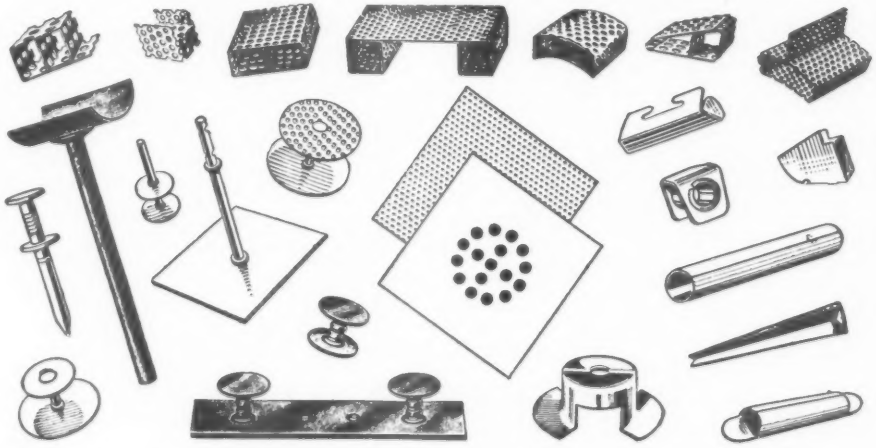

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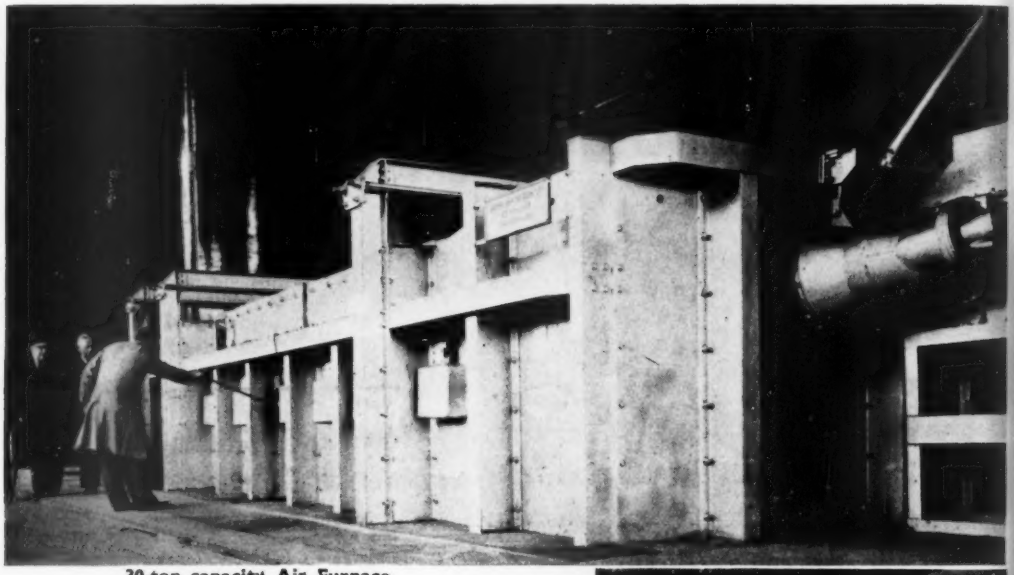

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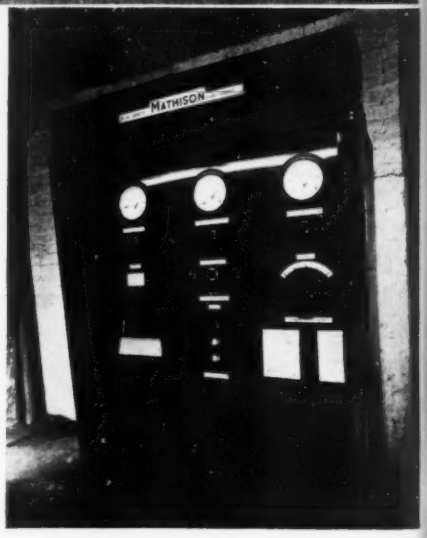

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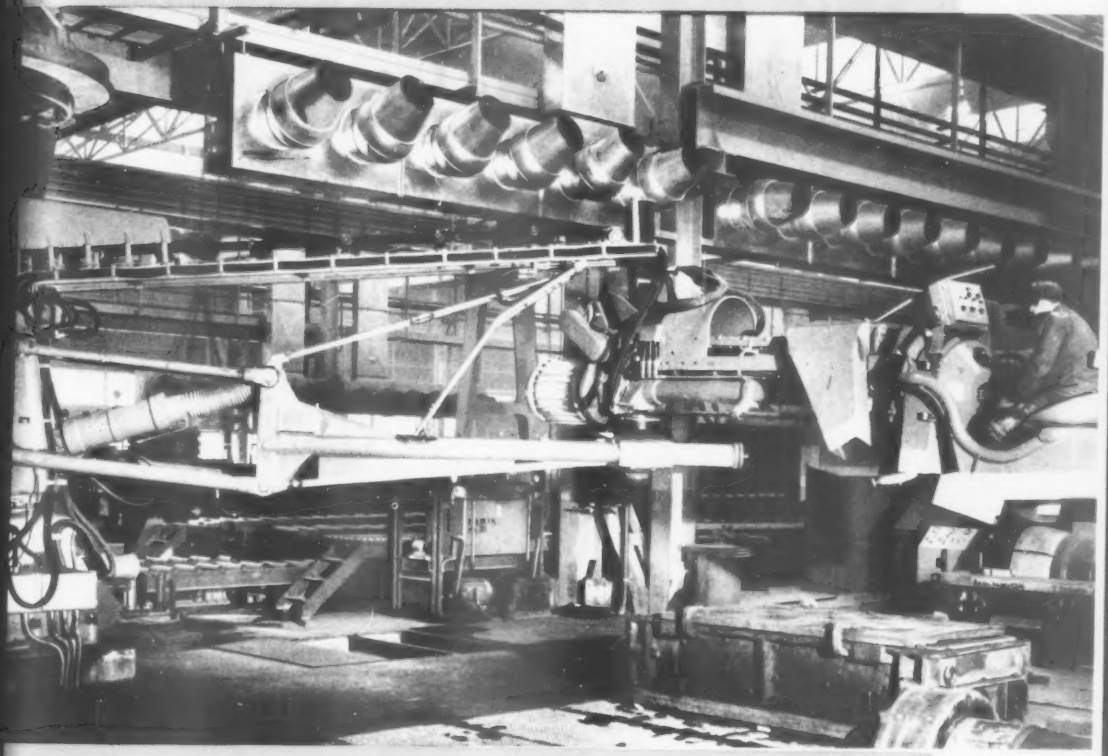

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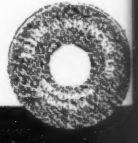

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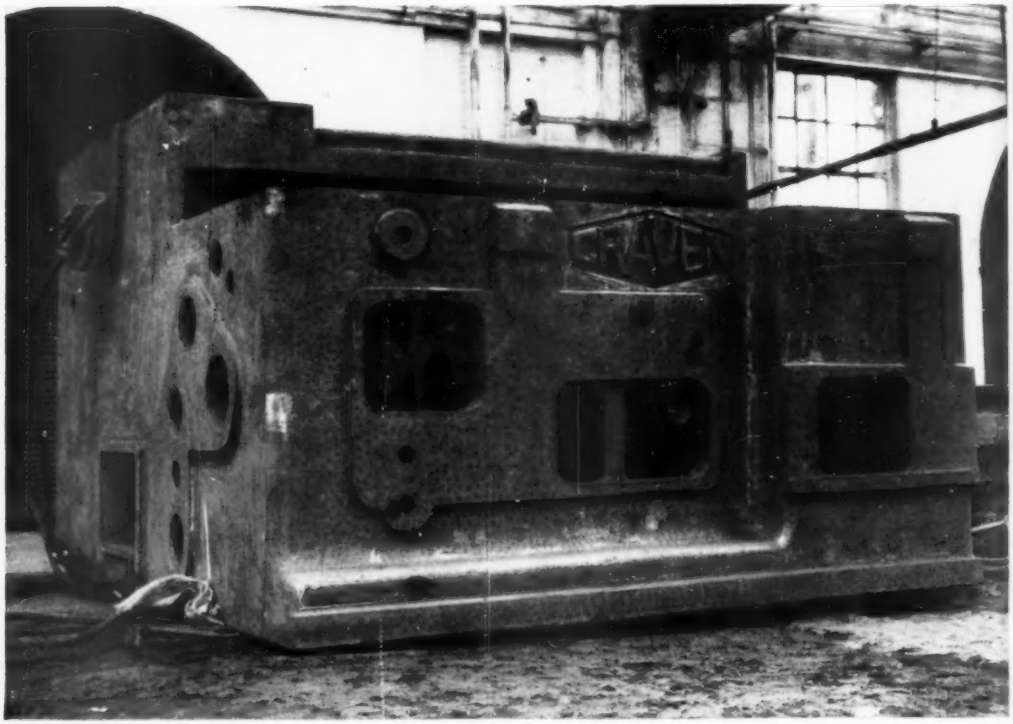

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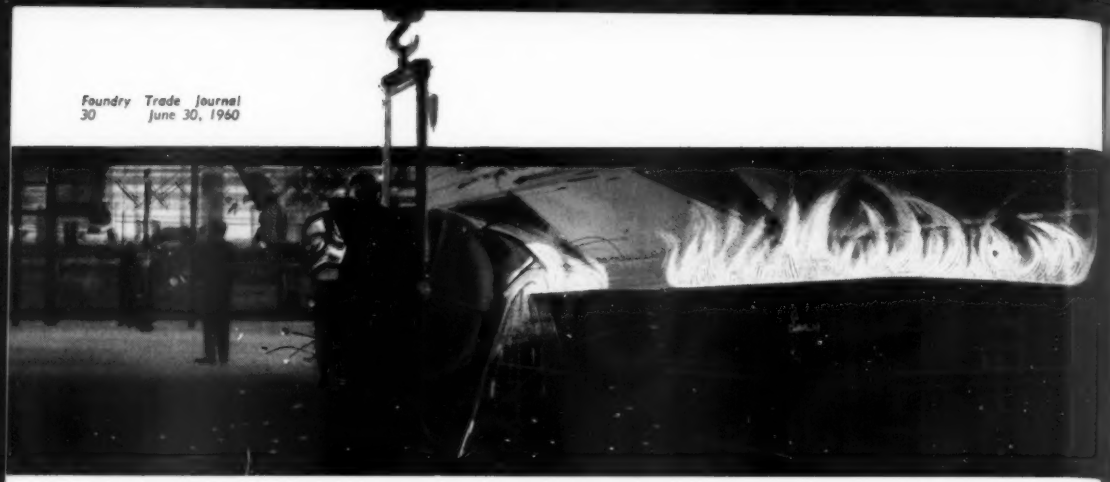

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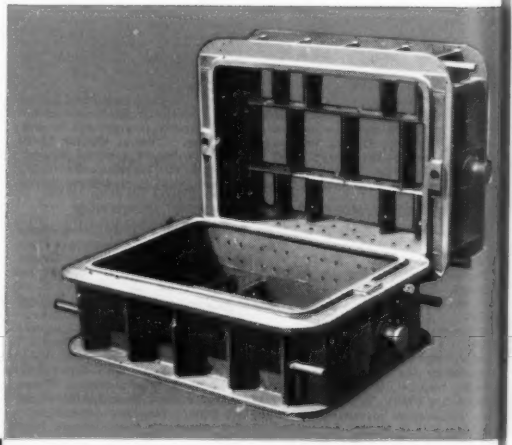

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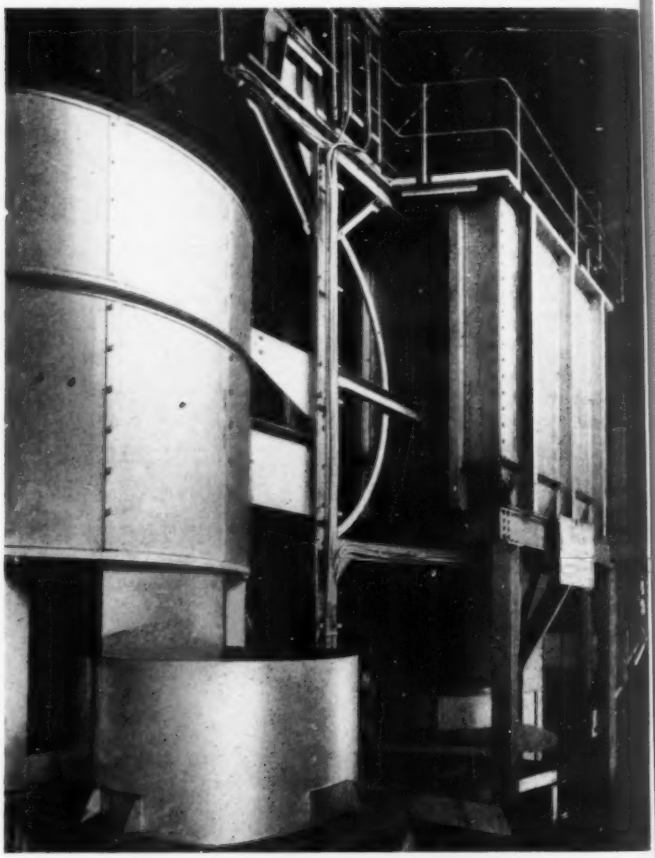

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FOUNDRY
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Vol. 108 June 30, 1960 No. 2273

International Machine Tool Exhibition

It is four years since the International Machine Tool Exhibition was last held and its opening on Saturday at Olympia, London, revealed the vast changes that have occurred in the intervening period. All the major machine-tools shown have either a separate " box of tricks " for automatic operation or provision is made in the actual machines for this to be arranged. This means that the machine-tool builders are at present relying to a large extent on " newish " firms which make automatic control equipment. The great halls of Olympia are indeed well filled with machinery from the leading industrial countries.

Foundry plant in the narrow sense is absent, though there are excellent—in fact, the best—examples of patternmaking machinery available anywhere in the world. However, there is at least one stand that sets itself out to discuss the mechanization of foundries, and examples of die-casting machines and a wide range of mechanical testing machines are also shown. Even the simple hardness-testing machines are now streamlined and stove-enamelled. Heat-treatment and other types of furnaces are included on a few of the stands. All these items are naturally quite overshadowed by the plethora of millers, planers, lathes, and the like. Yet even the latter have real interest for the progressive foundry executive, as the tendency within our industry is to supply machined or part-machined castings. Especially does this remark apply to steelfounders, because a large number of these operate their own machine-shops. At Olympia, a comparable range of machines will not be on view again for another four years.

There has been little attempt at showmanship on the part of the organizers as no doubt they rightly think that nothing should detract from the magnificent array of machinery on the stands. The individual standholders, in most cases, have not made the mistake of overcrowding the space they have available, as such action detracts from the appearance of the exhibits. (The Exhibition remains open until tomorrow week.)

Institute of Metals

Autumn Meeting in Bath

An attractive programme of technical sessions, social functions, works visits and sightseeing tours has been arranged for the autumn meeting of the Institute of Metals to be held in Bath from September 5 to 9. The technical sessions will be held in the Concert Room of the Pump Room and at the Old Sessions Court, Guildhall, Bath. Papers to be discussed will have the general themes of the "Engineering Properties of Nickel-base Alloys"; "Lubricants for Cold-rolling Aluminium," "Recovery and Recrystallization"; "Properties of Metals"; "Relative Methods of Extrusion and Other Methods for the Manufacture of Bar, Rod and Wire-rod" and "Magnesium Alloys for Fuel-element Components." The autumn lecture on "Metals and the World of Engineering Structures" to be delivered by Professor Sir Alfred Pugsley, Professor of Civil Engineering, University of Bristol, will precede the final business session on the morning of the last day, Friday, September 9.

Works Visits

The numerous works visits planned include Capper Pass & Son, Limited, Bristol; Stothert & Pitt, Limited, Bath; Westland Aircraft, Limited, Yeovil; Bristol Aircraft, Limited, and Bristol Siddeley Engines, Limited; Henry Wiggin & Company, Limited, Hereford; Imperial Smelting Corporation, Limited, Avonmouth; Westinghouse Brake & Signal Company, Limited, and Vickers Armstrongs (Aircraft), Limited, Swindon. It is hoped that visits may also be arranged to R. A. Lister & Sons, Limited; British Railways, Swindon; Western Diecastings, Limited; A.T. Poeton & Son; Philblack, Limited; Hoffman Bearing Company, Limited; the Dowty group of companies; Berkeley Power Station; Smith's Instruments, Limited; and the laboratories of the Central Electricity Generating Board and the National Coal Board, near Cheltenham.

The special programme arranged for the ladies will take them to many places of historical interest; to the Severn Wild Fowl Trust; a wine shippers; a cigarette factory; and a chocolate factory. The social side, too, has been well catered for with a cocktail party, civic reception and dance, and a banquet in the Guildhall.

The secretary of the Institute reminds members that although arrangements have been made with a number of hotels in Bath for provisional reservation of accommodation, reservations must be taken up directly with the hotel and not through the Institute; also that it is essential that application be made as soon as possible. Copies of a printed booklet "Holiday Accommodation in Bath," which gives the names and addresses of hotels, etc., may be obtained from the secretary.

£200,000 Research Centre for Hawker Siddeley

A new research centre for Hawker Siddeley Industries, Limited, to be established at Stockport, will provide basic research and development facilities in a single establishment for both the heavy-diesel-engine companies of Mirrlees, Bickerton & Day, Limited, and the National Gas & Oil Engine Company, Limited. The centre, which will cost more than £200,000, is expected to be completed early next year. It will be directed by Dr. Joseph Albert Pope, who joins the boards of both the Mirrlees and National companies.

Izons' Bicentenary

The West Bromwich firm of Izons & Company, Limited, well known for its cast-iron cooking utensils, has, in its 200th anniversary year, won a "Design of the Year Award" from the Council of Industrial Design for their anniversary ware casseroles, entree dishes and tricorn stand (see illustration below).

It was in 1760 that John Izon was established as a founder in Coleshill St., "In the parish of Aston, near Birmingham," and some 20 years later he moved his rapidly expanding business to a site in West Bromwich where there was ample land to build, a water mill to provide power, nearby coal pits at Wednesbury and a canal available for transport. To-day the Mill Estate is still the centre of the production of cast-iron holloware and the company now produces the widest range of cast-iron utensils in the world.

Cast-iron cooking utensils made by Izons & Company, Limited, West Bromwich, for which the company received a "Design of the Year Award" from the Council of Industrial Design.

NSMP—New Members

The National Society of Master Patternmakers' *Bulletin* No. 14, lists the following new members:—Robinson & Knee, Limited, 27 Proctor Street, Nechells, Birmingham, 7; E. W. Smith, Talbot Works, Burlington Street, Aston, Birmingham, 6; Constell Engineers, Limited, Mellor Street, Rochdale, Lancs.; Luton Engineering Pattern Company, Princess Street, Luton; Adcock & Shipley, Limited, Ash Street, Leicester, and W. Clough & Company, Holly Hall Works, Low Moor, Bradford.

Foundry Films

Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7, in a four-page leaflet, describe eight films they have in stock and which are available on loan free of charge to the organizers of meetings. All the films deal with some aspect of foundry practice, including operation of the CO_2 Process, exothermic feeding of steel castings, and American methods of overcoming zinc fumes in a brass foundry.

Factory Equipment Exhibition

The Factory Equipment Exhibition is to be held at Belle Vue, Manchester, September 21 to October 1.

Influence of the Silicon in Cast Iron on Corrosive Wear*

By R. Graham, B.Sc., Ph.D., O. S. Prado, M. H. Collins, B.Sc., Ph.D., E. A. Brandes, B.Sc., and H. K. Farmery, M.A., Ph.D.

The Authors first introduce the background to the investigations reported and give a brief assessment of the problem of wear with which they propose to deal. They continue by relating various series of experiments and the results obtained from them, in different localities. These include work on marine-diesel cylinder-liners and the devising of corrosion tests on a series of cast irons of controlled structures and varying silicon content at the Fulmer Research Institute. The results confirmed those obtained on engine tests carried out at the Thornton Research Centre. It should be borne in mind when assessing the results—and the implications—that the practical aspects of whether or not sound, machinable castings can be manufactured in low-silicon materials for the purposes described are not covered, and in fact the Authors confine themselves to one type of microstructure.

The prevention of wear in engines and other mechanisms is primarily a matter of lubrication although the materials of the working parts and their metallurgical structure can also be important. This is found to be so especially where operating conditions are severe and where boundary lubrication obtains over a significant part of the operating cycle.

A considerable amount of work has been done on the wear properties of cast iron and there is general agreement on the type of microstructure that is desirable where it is important to provide good resistance against abrasive wear. A grey iron is generally recommended for this purpose, having the free carbon in the form of graphite flakes of medium size randomly dispersed in a pearlitic matrix; the phosphorus present should be well distributed. In practice, the desired properties are most readily obtained with a silicon content between 1 and 3 per cent.

In certain machinery, however, wear (or the equivalent of wear), can occur by a process quite distinct from the simple erosion of surfaces caused by their rubbing together. Thus, where parts of a machine operate in a corrosive environment, metal may be lost through direct chemical attack on working surfaces. Corrosion products so formed are removed by the rubbing of the surfaces, leaving them exposed for further attack, and so on. This process is called corrosive wear. For example, it is wellknown that corrosive wear can be a major contributor to total wear in the diesel engine. Here, cylinders and piston rings are exposed to a corrosive atmosphere produced by the condensation of acidic combustion products on the metal surfaces.

It is wellknown that high-silicon irons have good resistance against corrosion, indeed an iron containing 14 per cent. silicon is the standard material for use with sulphuric acid. It therefore seems to have been assumed that wherever, for reasons of foundry technique, it was found desirable to increase the silicon content of a cast iron toward the upper end of the 1 to 3 per cent. range necessary to achieve optimium resistance to abrasion, then this would at the same time enhance the resistance of the metal against corrosion or corrosive wear.

At Thornton, Mr. L. S. Evans† was led to query this assumption as he accumulated data during examination of a large number of samples of cylinder-liners which had suffered corrosive wear in marine diesel engines. He postulated that silicon might, in fact, have had a deleterious effect on their corrosion resistance. Accordingly, a laboratory corrosion test was devised which employed sulphuric acid at concentrations and temperatures simulating engine conditions. Assessment of corrosion resistance of the marine cylinder-liners in the laboratory test confirmed that silicon could indeed lower the resistance of the iron to corrosion. These laboratory results pointed to important possibilities in field practice and it was decided to follow them up by asking Fulmer Research Institute to prepare a series of cast irons of controlled structure and varied silicon-content. The laboratory tests at Fulmer on these specially-prepared cast irons fully confirmed the earlier Thornton results, so trials were run in an engine and in a boiler combustion-rig to obtain indications of the significance of the laboratory corrosion tests to operating problems.

* Paper presented to the Institution of Mechanical Engineers and reproduced by permission. Of the authors, Mr. Graham, Mr. Prado and Mr. Collins are attached to "Shell" Research, Limited, Thornton Research Centre, near Chester; Mr. Brandes is associated with the Fulmer Research Institute at Stoke Poges, and Mr. Farmery with Courtaulds, Limited.

† *Admiralty Materials Laboratory, Poole, Dorset, formerly at Fulmer Research Institute.*

Silicon in Cast Iron

This paper presents the evidence obtained at Thornton Research Centre and the Fulmer Research Institute, indicating that cast irons with a silicon content in the region of 2 to 2½ per cent. have the least resistance to corrosion by acids, and that a reduction of the silicon content to about 1 per cent. can improve the corrosion resistance several fold.

EXPERIMENTAL AND RESULTS

Marine-diesel Cylinder-liner Samples

After the first indications that silicon could have an adverse effect on the wear of cast iron, samples of diesel-engine liners were submitted to a corrosive-wear test in the laboratory. The test conditions were chosen to simulate as far as possible conditions obtaining in an engine cylinder.

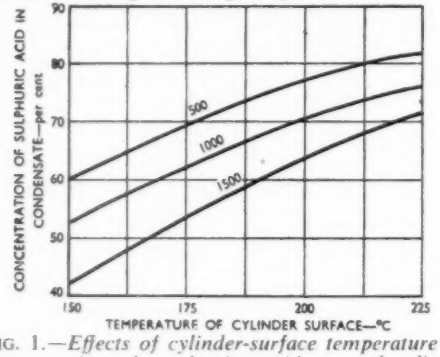

FIG. 1.—*Effects of cylinder-surface temperature on concentration of condensing acid at total cylinder pressures of* 500, 1,000, *and* 1,500 *lb. per sq. in.*

For this purpose it was assumed that acid attack begins in an engine cylinder when the temperature falls below the acid dewpoint. From the results of investigations by Greenewalt[3], Taylor[4] and Flint and Kear[5] (represented in Figs. 1 and 2), the strength of acid which would be condensed from the combustion gases of a normal diesel fuel at 160 deg. to 170 deg. C. would be around 70 per cent. The exact strength of acid would be dependent on the sulphur content of the fuel, the pressure in the cylinder and the cylinder-wall temperature. As the original samples of cast iron had been taken from large diesel engines, it was decided from consideration of data, such as are shown in Figs. 1 and 2, that an acid concentration of 70 per cent. would be suitable for use in the laboratory corrosion tests. Acid of this strength would represent that which would form first from the combustion gases as the temperature inside the cylinder fell, and although it would not match that which would, theoretically, deposit on a cylinder wall colder than 160 to 170 deg. C., it could be argued that it would be representative of the acid which having first formed, would contact the walls. Additionally, the corrosivity of sulphuric acid from 50 to 70 per cent. varies in degree rather than in magnitude.

For the test itself, machined test-pieces 1½-in. long and ⅜-in. dia. were immersed in 5 ml. of 70 per cent. sulphuric acid in a glass container, and the container was sealed. It was then heated to 130 deg. C. for the period chosen, that is, 1, 2, 5 or 16 hrs. This temperature was chosen as that representing a cylinder wall of below average temperature of operation as well as that approximating to the temperature of maximum attack on iron by sulphuric acid. The container was then broken, and the specimen was removed, quickly washed clean and weighed, the weight loss being expressed in milligrams.

The test results are plotted in Fig. 3. They left no doubt that silicon could have a serious adverse effect on the corrosion of cast iron. The increase in corrosion when the silicon content is raised from 0.8 to 1.8 per cent. is nearly tenfold. The highest silicon content in this work was about 1.8 per cent., and the corrosion curve was still rising at this value. Since at a silicon content of 14 per cent. cast iron was known to show good resistance to corrosion, it was assumed that at some intermediate silicon-content the curve would reach a maximum and then fall again.

The samples of cast iron used for these tests were accumulated over a period of several years and, apart from their silicon contents, they differed in other respects, such as constituents and microstructure. However, it appeared that these other differences were unimportant compared with silicon content.

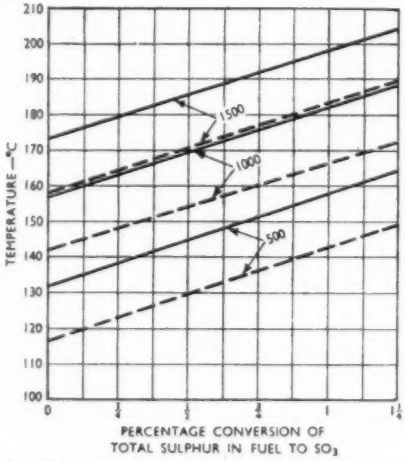

FIG. 2.—*Elevation of dewpoint by sulphuric acid in combustion products of diesel fuel containing* 1½ *per cent sulphur.*

———— Dewpoint.
– – – – – Temperatures at which maximum corrosion occurs.[5]

Studies at Fulmer Research Institute

The implications of the early tests were so far-reaching that it was decided to obtain independent confirmation of the results under more carefully defined experimental conditions. In particular it was desired: (1) To eliminate as far as possible all differences between specimens other than the sili-

con content. (For this purpose it was decided to keep the microstructure of the specimens constant even though this meant that the carbon content would vary; the earlier tests had indicated that the carbon content was not likely to affect the results), and (2) to extend the range of silicon content to the highest value consistent with the required microstructure, in order to find, if possible, the maximum in the corrosion curve.

Arrangements were accordingly made for the Fulmer Research Institute to cast and prepare suitable specimens and to test their corrosion resistance in the laboratory. Ten cast irons were produced, all having a fully pearlitic structure of the general type illustrated in Fig. 4. This structure was chosen because such an iron is generally accepted as having optimum resistance against abrasive wear. Fig. 5 gives the relative positions of the specimens on the carbon/silicon (Maurer) diagram [1,2]. Above 3 per cent. silicon, the fully pearlitic structure could not be maintained, either partly ferritic or partly white irons being produced. Details of the microstructure of the specimens were as follow: *Graphite:* flake, ASTM-AFA type A, size 3-4; *matrix:* fully pearlitic, the pearlite lamellae being just resolvable at a magnification of 300-350; *phosphide:* non-cellular, and well distributed; phosphorus content between 0·3 and 0·6 per cent.; no free ferrite, and structure non-dendritic.

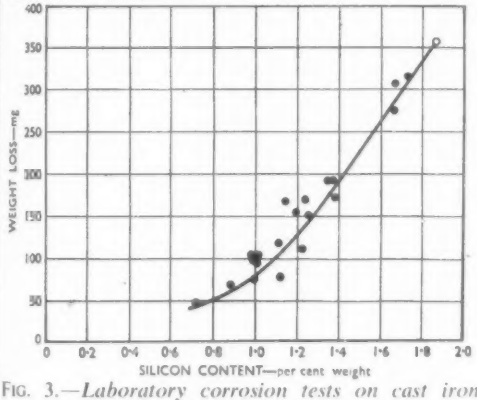

FIG. 3.—*Laboratory corrosion tests on cast iron from used cylinder-liners.*

Casting Conditions and Analysis

The irons were melted in a high-frequency induction furnace and cast into a sand mould. A suitable casting shape was found to be one having three steps 1¾-in. high and of diameters 1½ in., 2½ in. and 3½ in. with a 4-in. diameter feeder. The castings were made vertically, with feeding from a separate runner and bottom gating. Each step was examined metallographically and the closest to the required structure selected. In a number of cases, the casting had to be rejected for ferrite areas or for graphite flakes outside the required range. Analyses of the samples are given in Table 1.

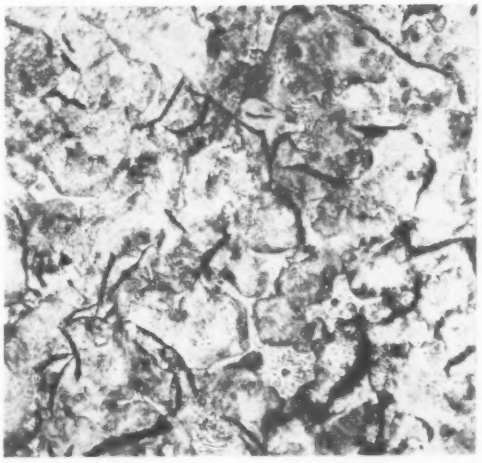

FIG. 4.—*General view of acceptable structure, showing graphite size, pearlite resolution and phosphide distribution (from cast No. L138A; etched in 2 per cent. nital).*

TABLE 1.—*Percentage Analysis of Cast Irons in order of Increasing Silicon Content.*

Cast No. L.	Silicon.	Carbon.	Manganese.	Phosphorus.	Sulphur.
159	0.59	3.96	0.18	0.34	0.020
149	0.71	3.60	0.29	0.41	0.046
155	0.94	3.54	0.28	0.42	0.043
146	1.26	3.30	0.29	0.38	0.045
180	1.37	2.84	0.23	0.35	0.040
152	1.64	2.75	0.30	0.36	0.039
137	1.90	2.71	0.73	0.51	0.036
138	2.36	2.49	0.62	0.53	0.035
156	2.55	2.18	0.48	0.40	0.030
158	2.96	2.06	0.47	0.42	0.027
140	3.44	1.83	0.54	0.4	0.04
151	3.56	1.77	0.4	0.4	0.02
141	4.17	1.46	0.4	0.5	0.02

Casts Nos. 140, 151 and 141 were used in the boiler tests only, and were not exactly to the structural specifications since they contained some ferrite islands.

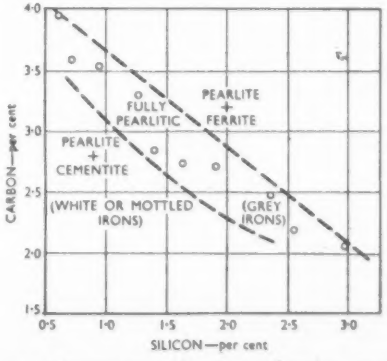

FIG. 5.—*Maurer-type diagram showing compositions of irons tested.*

Silicon in Cast Iron

Corrosion Tests at Fulmer

Resistance to corrosion was tested by the same method as was used at Thornton for the cylinder-liner specimens; the results are given in Table 2. In Fig. 6, the results have been plotted in the form of curves of corrosion against time of exposure for the various silicon contents. It is worth noting that for the lower silicon contents (0·59 to 1·37 per cent.) the corrosion rate decreases during the first five hours before reaching a steady value, whereas with the higher silicon contents (1·9 to 2·96 per cent.) the rate of corrosion increases during the first five hours; with an intermediate silicon content (1·64 per cent.) the rate of corrosion is substantially constant throughout the exposure. The significance of these differences is not at present understood, but they may provide a clue to the mechanism of the corrosion and to the part played in it by the silicon. For the 16-hour tests on the higher silicon irons, the acid was practically all consumed, but this does not appear to have affected the results, which are in line for those at shorter times. Tests for longer times would not be practicable unless the conditions were changed.

In Fig. 7, curves have been plotted of corrosion against silicon content for times of exposure up to five hours. Here it is evident that the maximum in the corrosion curve, for which there had been only indirect evidence, does indeed exist, corresponding to a silicon content of just over 2 per cent. It is interesting to note that the peak is asymmetrical, and that considerably more is to be gained by reducing the silicon content from 2 to 1 per cent. than by raising it from 2 to 3 per cent. A second interesting feature is that whereas for an exposure time of five hours the silicon content has a large effect on the corrosion, for the shorter exposure times the effect of silicon is progressively reduced. Since in an engine the time in each stroke during which the piston rings are exposed to corrosion is comparatively very short, it appeared that in practice the effect of silicon on piston-ring wear in an engine might be small, or even negligible. Even so, it was thought worthwhile to obtain evidence on this point.

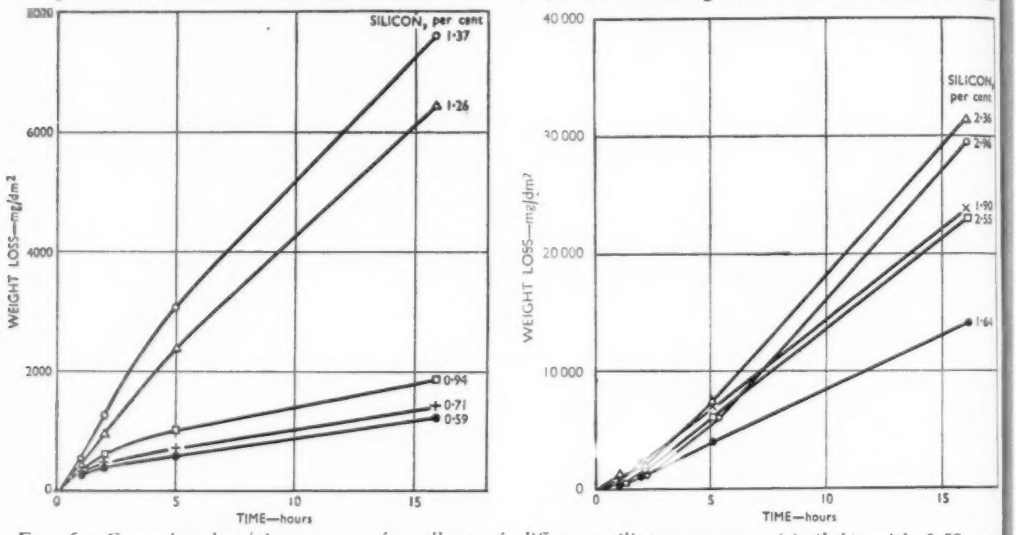

FIG. 6.—*Corrosion loss/time curves for alloys of different silicon content; (a) (left) with 0·59 to 1·37 per cent. silicon and (b) (right) with 1·64 to 2·96 per cent. silicon.*

TABLE 2.—*Results of Corrosion Tests in 70 per cent Sulphuric Acid, shown as Weight Loss per Unit Area.*

Cast No. L	Silicon, per cent.	Carbon, per cent.	Average weight loss, mg. per sq. dm.			
			1 hour.	2 hours.	5 hours.	16 hours.
159	0.59	3.96	279	403	601	1,220
149	0.71	3.60	310	465	682	1,380
155	0.94	3.54	341	620	1,020	1,860
146	1.26	3.30	465	977	2,390	6,430
180	1.37	2.84	542	1,270	3,090	7,560
152	1.64	2.75	542	1,190	4,170	14,200
137	1.90	2.71	852	2,280	6,850	23,800
138	2.36	2.49	1,040	2,050	7,500	31,500
156	2.55	2.18	713	1,750	6,110	23,100
158	2.96	2.06	682	1,340	6,010	29,600

Engine Tests at Thornton Research Centre

Although the studies described so far stem from observation of the behaviour of large marine engines, it was felt that a relatively small engine could be used, at least for a preliminary assessment of the importance of the corrosion rig results. Other extensive research in diesel engines had shown that corrosive wear can occur in all sizes of diesel engine and, furthermore, that engine size itself is of relatively little importance in its effect on this wear process.

Thus, for the engine tests, a single-cylinder diesel engine was used. This engine and the operating

TABLE 3.—*Engine Operating Details and Test Procedure.*

The engine used in this research was a laboratory type, vertical, single-cylinder, four-stroke diesel engine, fitted with automatic controls to enable the unit to be run continuously and without attention other than during normal working hours.

The following test procedure was observed:—

Duration	40 hr. (continuous running)
Speed	1,000 rev. per min.
B.m.e.p.	84 lb. per sq. in., approximately
B.h.p.	9.0
Fuels	(*a*) 1.95 per cent by weight of sulphur gas-oil (*b*) 0.1 per cent by weight of sulphur gas-oil
Oils	(*a*) Straight mineral oil (*b*) Additive oil to 0.78 per cent by weight sulphated ash
Jacket coolant temperature	80 deg. C.
Exhaust gas temperature	480 deg. C.
Sump oil temperature	Uncontrolled (67 deg.C. approximately)
Make-up oil added	None
Oil pressure	20 lb per sq. in.

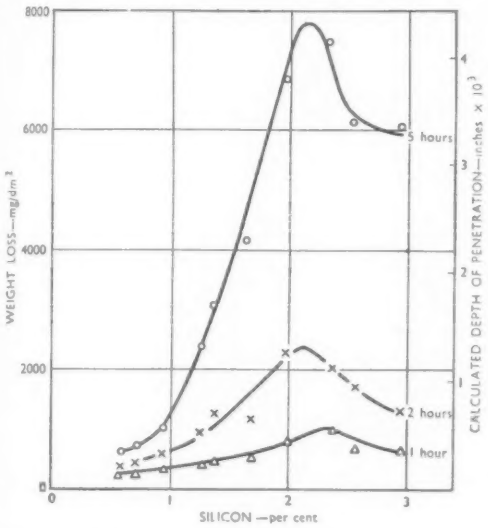

FIG. 7.—*Effect of silicon content on corrosion resistance.*

conditions used in the present work (Table 3) were chosen on the basis of other invesigations outside the scope of this paper.

The test-piece itself was the top piston ring of the engine which was one of two kinds: low-silicon iron or high-silicon iron. These rings were machined at Thornton from cast-iron cylinders made at Fulmer to the same general specification as the corrosion-test specimens. The percentage compositions of the rings were:

	Casting No.	Silicon.	Carbon.	Manganese.	Sulphur.	Phosphorus.
Low-silicon iron	101	0.95	3.57	0.32	0.052	0.46
High-silicon iron	106	2.00	2.63	0.32	0.022	0.46

Four rings were machined from each casting to the standard dimensions for the engine. The exact dimensions are given in Table 4. No difficulties were encountered in the casting or machining of either material.

TABLE 4.—*Dimensions of Piston Rings used in the Engine Tests (in inches).*

Ring No.	101.		106.	
	Width.	Thickness.	Width.	Thickness.
1	0.094	0.140	0.095	0.142
2	0.095	0.142	0.094	0.139
3	0.094	0.142	0.095	0.141
4	0.095	0.145	0.094	0.141

Two series of engine tests were run. In the first series, the two types of piston ring were compared under conditions where corrosive wear in the engine would be predominant. For this series of tests, a fuel having a relatively high sulphur-content was used, namely 1 95 per cent. by weight, and a straight mineral lubricating oil.

In the second series of tests, corrosive wear was suppressed by using a very low-sulphur fuel (0·1 per cent. by weight) and an additive-type oil which itself would neutralize acidic combustion products before they would reach the piston rings or cylinder walls. Thus, by comparing the behaviour of the two types of ring in these different tests, it was hoped to distinguish between effects due to the corrosion resistance of the different ring materials and other possible effects such as their resistance to abrasive wear.

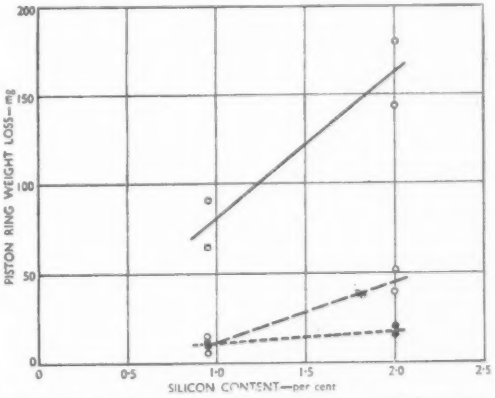

FIG. 8.—*Engine tests: Piston-ring weight-loss for irons of high and low silicon content.*

Key: o —1.95 per cent, and ● —0.1 per cent by weight sulphur. ——— Corrosive conditions; – – – – practical conditions, and – – – – non-corrosive conditions.

The criterion of the tests was the weight loss of the experimental rings. Two tests were run at each level of the variables and the results are given in Table 5 and plotted in Fig. 8.

The repeatability of the tests was highly satisfactory, and it will be seen from Fig. 8 that under

TABLE 5.—*Top-ring Weight-loss in Engine Tests.*

Fuel: weight of sulphur, per cent.	Oil.	—	Low-silicon rings.		High-silicon rings.	
1.95	Straight mineral oil	Sequence of test..	4	6	2	7
		Ring No. ..	101/2	101/4	106/2	106/3
		Weight loss, mg...	90.5	64.7	180.4	144.0
	Additive oil	Sequence of test..	3	5	1	8
		Ring No. ..	101/1	101/3	106/1	106/4
		Weight loss, mg...	5.6	14.7	52.0	39.9
0.1	Additive oil	Sequence of test..	9	11	10	12
		Ring No. ..	101/3	101/1	106/1	106/4
		Weight loss, mg...	10.8	12.4	20.3	15.9

Low-silicon rings: 0.95 per cent. by weight, silicon; high-silicon rings: 2.00 per cent. by weight, silicon; straight mineral oil: Venezuelan high-viscosity index oil of SAE 30 grade; additive oil: Venezuelan high-viscosity-index oil of SAE 30 grade with detergent additive to 0.78 per cent. by weight ,sulphated ash, and, effective additive at end of test: 65 per cent. of initial value.

The results of these tests are also included in Table 5 and in Fig. 8. These indicate that although the additive oil eliminates a substantial proportion of wear due to corrosive influences, the use of ring material with the superior corrosion resistance can indeed make a further really worth-while reduction.

Boiler Combustion-rig Tests at Thornton

Although the investigation of the effect of silicon had been started in connection with a diesel-engine problem, and although the findings clearly had an important application in internal-combustion engines, it was realized that the results obtained at Fulmer were of more general significance. The corrosion of cast iron is a widespread problem wherever this metal is used for constructional purposes, whether it is exposed to acid-containing gases

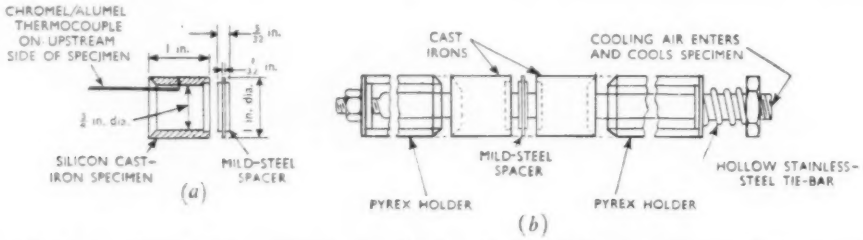

FIG. 9.—*Boiler combustion-rig test-specimens: (a) Details of tubular specimen and (b) assembly of specimen.*

conditions conducive to corrosive wear, the rings with the lower silicon content had a substantially greater resistance to wear than had the higher-silicon iron rings. This effect, although consistent with the findings of laboratory rig corrosion tests, could have been due to factors other than the greater resistance of the low-silicon iron rings to corrosion. However, in the second series of tests in which corrosive influences were suppressed, there was relatively little difference between the wear rates of the two different types of ring. This gives strong support to the view that the large difference in behaviour in the first series of tests was due almost entirely to the superior corrosion resistance of the lower-silicon iron.

It might be argued that the engine test results discussed so far were obtained under conditions of academic interest only. In practice, it is unlikely that a straight mineral oil would be used in conjunction with a fuel having a sulphur content as high as 1·95 per cent. It was of interest then to determine whether the superior corrosion resistance of the lower-silicon iron could make a useful contribution to wear reduction in normal circumstances or whether in fact its improved characteristics would be swamped by the use of acid-neutralizing oils.

To furnish information on this point a third series of tests was run—this time with the high-sulphur fuel and a conventional H.D. additive oil.

or liquids in industrial plant or merely to the acidic atmosphere in a large city.

Specimens were therefore submitted to tests in a boiler combustion rig which was available at Thornton. This rig consisted essentially of a burner

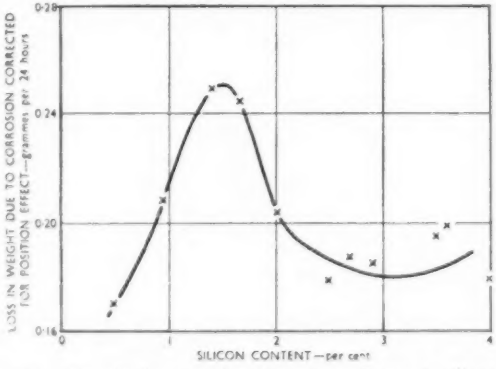

FIG. 10.—*Boiler combustion rig: effect of silicon content on corrosion of specimens (Each point is the mean of three results).*

to generate combustion gases and a section some way downstream in which the specimens were exposed. It was operated so as to simulate conditions at the surface of the specimens which would obtain

in an air heater where the surfaces are at a temperature below the acid dewpoint. The fuel was a distillate containing 2 per cent. by weight sulphur, and was burnt with 30 per cent. excess air to give a carbon-dioxide content of 12 per cent.; combustion was thus complete and no soot was formed.

Of the specimens tested, eight were from cast irons that had been used in the corrosion tests at Fulmer, covering the range of silicon content 0·59 to 2·96 per cent. and three further specimens were added to extend the range to 4·17 per cent. silicon.

TABLE 6.—*Boiler Combustion-rig Test-results.*

Cast No. L.	Silicon content, per cent. by weight.	Average weight loss of specimen corrected for position effect, gm. per 24-hr.
159	0.59	0.170
155	0.94	0.210
146	1.26	0.245
152	1.64	0.240
137	1.90	0.205
138	2.36	0.178
156	2.55	0.185
158	2.96	0.183
140	3.44	0.193
151	3.56	0.200
141	4.17	0.178

The materials tested are given in Table 6, and their compositions in Table 1.

The specimens were machined into the form of small cylinders of ¾-in. dia., and mounted in pairs on hollow tie-bars as shown in Fig. 9. The rig accommodated six of these tie-bars, so that all the specimens could be exposed simultaneously. Cooling air was passed through the centre of the tie-bars and maintained the specimens at a temperature of 120 deg. C. independently of the temperature of the combustion gases. This temperature of 120 deg. C. was below the acid dewpoint and was the temperature at which acid condensation was expected to be greatest.

Three tests were carried out. In each test the specimens were first weighed, then exposed in the rig for 24 hrs. At the end of the test period, they were removed, quickly washed in distilled water, cleaned and reweighed. The surface of each specimen was then prepared anew as well as possible for the next exposure.

The average weight losses for the three tests are given in Table 6; they have been plotted to show the effect of silicon in Fig. 10. In comparison with the results of the engine tests, the effect of silicon was unexpectedly small, for in raising the silicon content from ½ to 1½ per cent. the corrosion was increased only one and a half times. The effect was still significant, however. The results differed from those obtained at Fulmer in that the corrosion peak occurred at a silicon content of about 1½ per cent. rather than 2 per cent. or slightly over. If anything, they place even more emphasis on the desirability of a low silicon content.

COMMENT

The conclusions to be drawn from this work should be of great importance to engine manufacturers, boilermakers and all concerned with the use of cast iron in acidic environments. The current practice is to select a silicon content which will allow the desired microstructure to be most readily attained and which will facilitate the production of sound castings; if this silicon content is rather higher than usual, then it has generally been assumed that at least the resistance of the iron to corrosion will be improved. The results presented show that more often than not such a practice leads to cast irons which, on the contrary, have a minimum resistance to corrosion. The results also show that corrosion resistance can be most readily ensured by keeping the silicon low—certainly not higher than 1 per cent., and if possible lower still.

Although the general indications are clear, the results from the different tests are not wholly consistent. Thus, the magnitude of the effect of silicon was greater in the engine tests and less in the boiler corrosion tests than had been anticipated from the laboratory tests. Again the differences in the shape of the corrosion curves in Fig. 6 at present remain unexplained. These features are possibly connected with the mechanism of the corrosion of cast iron and the way it is influenced by silicon. (This is one aspect on which further work is needed.)

Most of the work reported was done with one particular type of cast iron, namely one having a fully pearlitic microstructure and graphite flakes of fairly large size as is usual in diesel-engine practice. This was chosen because it is the type having maximum resistance against abrasion and therefore most likely to be used in internal-combustion engines and other moving machinery. No direct evidence is available that results will hold for other types of microstructure. In the first corrosion tests carried out at Thornton, where the samples represented a wide range of manufacture, such differences appeared to be unimportant but, since all the samples were from marine-diesel cylinder-liners with the same general-performance requirements, the variations in structure are not likely to have been very great. Where cast iron is used, for example, in boilers, where abrasive wear is not important, it may well be that ferritic types would show to advantage. These are other aspects on which further work is desirable.

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ORDERS VALUED at £11,000,000 for diesel locomotive equipment have been placed by the British Transport Commission with five British manufacturers—Associated Electrical Industries, Limited, Bristol Siddeley Engines, Limited, the Brush Electrical Engineering Company, Limited, the North British Locomotive Company, Limited, and J. Stone & Company (Deptford), Limited. The equipment comprises diesel engines and transmissions for 170 main-line locomotives which are being built in British Railways' workshops.

Company News

SAUNDERS VALVE COMPANY, LIMITED—A final dividend of 12½ per cent. makes 20 (17½) per cent. for the year ended March 31, 1960. Group net profit rose to £170,132 (£126,039), after tax of £181,500 (£124,000).

CAMBRIDGE INSTRUMENT COMPANY, LIMITED—Second interim dividend of 4 per cent. makes 8 per cent., less tax, to date in respect of 1960. For the previous year four interim dividends and a final, each of 2½ per cent., made 12½ per cent., tax free.

GEORGE W. KING, LIMITED, mechanical-handling engineers, etc., of Stevenage (Herts)—Net profit of £132,926 for 1959 compares with £105,346, after tax of 132,355 (£100,811). The dividend is raised to 12½ per cent. against the equivalent of 10 per cent.

JOHN BOOTH & SONS (BOLTON), LIMITED, structural engineers, bridge builders, etc.—Following a sharp setback the final dividend of 7½ per cent. makes 12½ (27½) per cent. for the year ended March 31, 1960. Trading surplus is down from £145,901 to £23,213, subject to tax of £9,054 (£71,620).

MIDLAND TAR DISTILLERS, LIMITED—Group net profit for the year ended March 31, 1960, rose from £120,021 to £206,805, after tax of £165,551 (£114,112). The dividend is raised to 12½ per cent. against 7½ per cent.—equal to 10 per cent. per annum—for the previous nine months' period.

F. TURNBULL & COMPANY (ENGINEERS), LIMITED, mechanical-handling and structural engineers, of Newcastle-upon-Tyne—Profits for the year ended March 31, 1960, fell sharply from £14,849 to £206, before tax of nil (£6,251). No dividend is recommended on the ordinary shares against 8 per cent. last year.

FERRANTI, LIMITED, electrical and general engineers, Hollinwood (Lancs)—Record outputs were achieved by the electronic computer, power transformer, and electricity meter departments in the year ended March 31, 1960, when group net profits increased from £1,104,572 to £2,123,390 after tax of £1,854,000. The dividend on the privately held £2,000,000 ordinary is again 6 per cent.

TUBE INVESTMENTS, LIMITED—The company has acquired Loewy Engineering Company, Limited, a private concern making hydraulic machinery and rolling mill equipment, of Poole (Dorset). The terms have not been disclosed. Loewy will continue to operate as before with no change of management. Mr. K. Guttenstein, remains chairman, and Mr. E. K. L. Haffner, and Mr. M. Langen joint managing directors.

BELLISS & MORCOM, LIMITED, manufacturers of steam turbines and engines, etc., of Birmingham—Group loss of £144,990 was incurred in the year ended March 31, 1960, against a profit of £89,287. Following the cut in the interim from 4 to 3 per cent. no final is recommended, against 4 per cent. last year. Intake of orders has improved this year and in addition certain changes are being made in the sales organization so that the company should return to a profit-earning basis during the current half year, state the directors.

DAVY-UNITED, LIMITED, holding company of specialists in hydraulic presses, rolling mills, etc., of Sheffield—Net profit in the year ended March 31, 1960, was £1,231,020 (£886,932), after tax of £1,124,583. Special interim dividend, in lieu of a final, is 22½ per cent., as forecast last month when the merger was proposed with the Power-Gas Corporation, Limited. The dividend, on a capital doubled by a scrip issue, absorbs £416,064, against £277,375 required to pay the equivalent of 15 per cent. for the previous year.

Export Quotas raised between UK and Russia

Higher quotas for the export of consumer goods, machinery and equipment were agreed at the annual review of Anglo-Soviet trade which finished in London last week. The consumer goods quotas for the next year were set at £4,000,000 each way, compared with £3,400,000 in the year to June 30, and the new quota for the import of Soviet machinery, equipment, and instruments into the UK was fixed at £2,500,000 against the previous total of £1,150,000. No breakdown of the type of goods covered by the new quotas has yet been fixed.

According to the latest issue of Vneshnaya Torgovla (Foreign Trade), Soviet exports of iron ore moved up from 6,300,000 tons in 1953 to 13,400,000 tons in 1959, and rolled steel from 1,200,000 tons to 2,400,000 tons. Imports of machinery in 1959 totalled just under £500,000,000, four-fifths of it from other Communist countries. Imports in general were up about 20 per cent. on 1958, and machinery by 25 per cent.

The Rustyfa group of companies stated last week that after negotiations with the Soviet trade delegation in Britain it had concluded an addition to its contract with Techmashimport of Moscow for £1,000,000 to cover spare parts for the tyre factory being built at Dniepropetrovsk. Total orders so far received for this project amount to £16,000,000.

Profits rise for Allied Ironfounders

Net profits of Allied Ironfounders, Limited, advanced from £720,878 to £1,355,576 in the year ended April 2, 1960, and the dividend is raised from 12½ per cent. to 20 per cent., with a final of 12½ per cent. Profit figure was reached after tax of £1,204,756, depreciation of £468,265, and crediting investment income of £82,065.

The increase, it is stated, reflects increased activity in all sections of the group's business, the elimination of the loss of £271,629 in Australia shown in the previous accounts and the inclusion of three months' additional profit from the South African subsidiary.

Last year £700,000 was provided to cover the estimated loss on realization of fixed assets of the Australian subsidiary. Of that provision £290,000 was not required and has been brought back to the credit of the appropriation account.

Optimistic outlook for F. H. Lloyd

Improvement in trading towards the end of the financial year ended April, 1959, continued in the past year and is reflected in the better results, state the directors of F. H. Lloyd & Company, Limited, steel founders and engineers of Wednesbury (Staffs). There is increasingly keen competition from both British and foreign producers, but the volume of business is being maintained and future results should continue to improve.

The provisional group net profit of £401,400 compares with £345,149, after UK tax (less £34,378 (nil) relief) of £281,339 (£302,779). The annual dividend of 10 per cent. makes 12½ per cent. for the year on a capital increased by a one-for-five scrip issue, an effective increase of 2 per cent.

X-ray Spectrometer in use at Yorkshire Engineering Supplies, Limited

Technical Description and General Comments on Performance Obtained

TECHNICAL DESCRIPTION*

In spectrometry employing optical spark or arc techniques, it is the molecules of a substance under examination which are excited to produce radiations which go to make up the characteristic optical spectrum. With X-ray spectrometry, however, the sample under test is bombarded by a beam of X-ray photons of sufficiently high energy so as to excite the electrons in their orbital levels or "shells" around the atom nucleus. This disturbing and re-ordering of the electrons causes an energy change in the atom structure to occur and less energetic secondary X-ray photons—termed fluorescent radiations—are re-emitted from the sample.

Since these fluorescent radiations consist of X-ray wave-lengths which are characteristic of the individual elements comprising the test sample, it will be appreciated that by exploring the spectrum of rays so produced with a suitable analysing crystal and detector, it is possible to identify these elements individually. Furthermore, the intensity of any particular wavelength within the spectrum will therefore indicate quantitatively the concentration of the particular element present in the sample which that wave-length signal—or Bragg angle—represents.

Y.E.S. Installation

In July 1959, Yorkshire Engineering Supplies, Limited (Y.E.S.) became actively engaged in the exploration and development of X-ray spectrometric techniques using a phase 1 model, twin-path automatic fluorescent X-ray spectrometer† (Figs. 1 and 2). This spectrometer is believed to be unique in that two samples—a standard reference sample and the analysis sample—are irradiated by a beam of hard X-rays at one and the same time. In this way, X-ray-tube fluctuations, temperature effects and drift phenomena are obviated and simplified calibration graphs and improved accuracy are achieved.

The X-ray tube employed has a tungsten anode and a 1.5-mm. beryllium window and receives voltage and current up to 50 kv. and 40 ma. from a fully stabilized h.t. generator incorporating selection-step switches and indicating meters. The X-ray tube is enclosed in a water-jacket for cooling purposes and protected by a flow-control switch which serves to trip out the h.t. generator should the water-cooling supply drop below a predetermined safe limit.

Both the reference and analysis samples (of about 1½-in. dia.) are enclosed in sample holders fitted with safety interlocks and proofed against scattered radiations. About 0.8 sq. in. (572 sq. mm.) of each of the two sample faces are exposed to the primary X-ray beam, coupled with a penetration depth of some 0.010 in. below the respective specimen surfaces.

The less-energetic X-ray photons or fluorescent radiations which are emitted from the reference and analysis samples at one and the same time are directed on separate and parallel paths through the primary collimators of the instrument, which are made up of a stack of parallel, closely-spaced, blades of thin molybdenum, which serve to reduce

FIG. 1.—*Solatron phase-I automatic fluorescent X-ray spectrometer as originally installed at Yorkshire Engineering Supplies, Limited. The operator is inserting a sample in the specimen holder.*

* Contributed by Dudley Nourse, A.R.Ae.S., L.I.M.

† Produced by Solartron Industrial Controls, Limited, of Farnborough, Hants.

X-ray Spectrometer at Y.E.S., Limited

scatter and improve resolution of the radiations. These collimated beams of photons are directed on to the cleaved face of twin lithium-fluoride crystals and thence *via* secondary collimators to detectors in the form of scintillation counters mounted on photomultiplier tubes. These detectors are supplied with high voltage from an e.h.t. unit in the electronics rack. The intensity of fluorescent radiation is converted into electrical pulses, pre-amplified, and the corresponding pulse signals are passed through to the linear amplifiers, also located in the electronics rack.

Programme Control

The angular position of the detector assembly and lithium fluoride crystals for any selected Bragg angle is controlled or programmed by synchro-transmitters in the electronics rack. Here, on separate channels (maximum 24), dials calibrated in 1 deg. and 0.01 deg. divisions are used for setting up manually the Bragg angle for any particular element required, *e.g.* Ni. 24.33 deg., Cu. 22.51 deg., Zn. 20.89 deg., Pb. 16.99 deg., Sn. 7.02 deg., etc. In operation, the synchro-transmitters relay this information to the spectrometer table *via* a magslip servo-system, and the corresponding angular position of the detector assembly and crystals—which are geared together in a 2:1 ratio—is therefore established.

As stated previously, pulses from the detectors are received by linear amplifiers in the electronics rack. One linear amplifier accepts the pulse beam from the reference channel, whilst the second amplifier receives that of the analysis channel. Here, the amplitude of the pulses are selected by attenuator settings, pulses below certain critical values being rejected by a discriminator bias control. The shaping of the pulses is controlled by rise and fall time-selection switches.

Recorders

From the linear amplifiers the pulses are fed to twin banks of electronic scalers (Dekatrons) comprising six decades per bank. As with other associated equipment described earlier, one scaler bank receives the reference path pulses whilst the other receives the analysis path pulses. The incoming pulses are counted on the respective scalers and, after a pre-set number of pulses have been counted on the reference path, the quanta-count value recorded on the analysis path is automatically printed out on paper tape. This printed count-value therefore represents the ratio of the number of pulses received from the peak of identical elements within the reference and analysis samples and, as such, may be rapidly converted to percentage composition.

Ranges

The initial pre-setting of the count to be collected by the reference path is controlled from a fixed count-value selector-switch which permits a choice of one of seven count-values as follow: 1,000, 3,000, 10,000, 30,000, 100,000, 300,000 or 1,000,000. In addition there is a "select" position which permits count-values between 1,000—999,000 in steps of 1,000 to be set up. If desired, seconds can also be counted by feeding 100 c/s pulses from a crystal oscillator into the first decade.

Accuracy and Identification

It will be obvious that the choice of the count-value determines the time taken for an analysis and, what is more important, the degree of accuracy obtained; the longer the counting time on any given element the greater the degree of accuracy recorded.

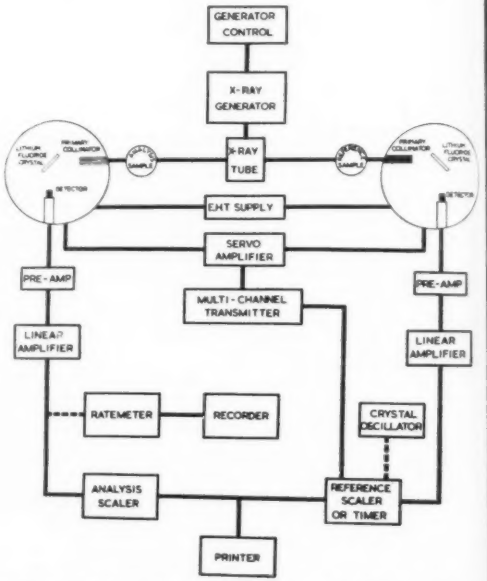


FIG. 2.—*Schemmatic diagram of the X-ray spectrometer indicating the principle and layout of the equipment.*

As an alternative to counting on the electronic scalers, the pulses may be fed to a chart recorder *via* a ratemeter. With this technique, the complete spectrum of fluorescent radiations are scanned by the detectors as the latter are slowly traversed at a constant speed from a selected low Bragg-angle. As the detectors pass through the various wavelengths present, peaks are drawn on the chart recorder, the respective positions of which immediately identify all of the elements present in the sample.

PERFORMANCE

The Solartron phase 1 spectrometer is not fitted with vacuum equipment and is capable of analysing all elements with atomic numbers above 20 (calcium) and with concentration ranges from about

0.05 to 100 per cent. Elements in mixtures, compounds and alloys, whether they be in liquid, powder or solid form, can also be determined, both qualitatively and quantitatively.

A study and understanding of the complexity of certain inter-element absorption effects is necessary before accurate quantitative determinations can be made. Experience has shown that the Solartron spectrometer has the sensitivity of a research instrument coupled with the robustness of a production tool. On the one hand, and under favourable conditions, trace elements of the order of a few parts per million can be detected, whilst on the other hand, trouble-free rapid routine analyses on an all-day and every-day basis has been proved over several months of operation.

Repeatability and Scatter

In this respect, an extensive exploration has been carried out by Y.E.S. laboratory technicians of the repeatability and limits of statistical scatter of analysis results obtained on a binary tin/bronze sample of which the copper and tin contents were collectively determined every 1¼ min. for a 9-hr. operating period per day. This was continued on a five-day week basis for a month—i.e., 22 days of operation—resulting in the recording of 6,788 copper and tin determinations. From this experiment it was proved that the repeatability of the analysis results were of an excellent order, the statistical scatter being of negligible proportions.

Y.E.S. is believed to be the first company in the world to employ this type of spectrometer for the quantity control of bronze castings produced in their foundries. Selected elements or groups of elements are now programmed and automatically analysed in a matter of seconds and minutes compared with hours, and sometimes days, by orthodox wet-analysis techniques.

Bronze melts are now held until analysis of a sample has confirmed that the material meets specification requirements. The balance of alloy compositions can now be controlled to narrow limits, thus permitting the maximum of economy to be exercised in relation to expensive virgin-metal additions to melts. Furthermore, specific balances of composition—to aid both castability and soundness, or to assist in providing some necessary property in the ultimate casting—are now ensured.

Typical Speeds and Accuracies

Some indication of the approximate speed of analysis, to accuracies of 0.5 and 0.1 per cent. of the content, for pure copper, tin, lead, zinc and nickel are as shown in Table 1, while Table 2 quotes

TABLE 1.—*Speed and Accuracy of the Spectrometer*

Pure Metal.	Rate of Counting (Pulses per sec.)	Analysis Time (sec.) for Accuracies of:— 0.5 per cent.	0.1 per cent.
Copper	21,000	4	100
Tin	7,000	12	300
Lead	3,500	26	650
Zinc	16,500	6	160
Nickel	22,000	3	68

results which reflect typical values obtainable on samples representing high-purity virgin-metal melts, conforming to the requirements of BS.1400 specification. Count-value selection-times of copper 10^6, tin 3×10^4, lead 10^4 and zinc 3×10^4 were employed which, in this instance, correspond to analysis times of 65 secs., 56 secs., 37 secs. and 49 secs., respectively.

TABLE 2.—*Typical Results obtained on Virgin-metal Melts.*

Alloy.	Composition, per cent.* Cu.	Sn.	Pb.	Zn.
BS. 1400—G1—C ..	87.92 (±0.132)	10.29 (±0.03)	0.06 (±0.00)	1.65 (±0.02)
BS.1400—LG2—C ..	85.63 (±0.129)	5.30 (±0.01)	4.97 (±0.02)	4.02 (±0.01)
BS.1400—LG3—C ..	85.88 (±0.129)	6.99 (±0.02)	2.24 (±0.02)	4.80 (±0.01)
BS.1400—LB1—C ..	76.25 (±0.114)	8.79 (±0.02)	14.87 (±0.07)	0.03 (±0.00)
BS.1400—LB2—C ..	80.68 (±0.121)	10.07 (±0.03)	9.33 (±0.04)	0.06 (±0.00)

* The values in brackets represent accuracy tolerances, per cent.

Surface Preparation and Orientation

The preparation of the surface of the sample

FIG. 3.—*Phase-II spectrometer which is shortly coming into operation at the Yorkshire foundry. It is a 24-channel twin-path unit in which 24 different elements with atomic numbers down to 12 can be programmed at one time.*

X-ray Spectrometer at Y.E.S., Limited

and the orientation of the sample in the specimen holder does play some part in influencing the results obtained. In this respect, experience has shown that only small variations are revealed in analyses of copper, tin, lead, and zinc contents of a leaded gunmetal the surface of which was prepared on separate occasions to widely varying standards of finish. Experimental work has indicated that the type of surface finish is more critical than the orientation of the sample in influencing the stability of test results.

Y.E.S. intend shortly to replace their phase-I X-ray spectrometer with a new phase-II instrument made by the same firm (Fig. 3). This is a 24-channel twin-path spectrometer in which up to 24 different elements with atomic numbers down to 12 (magnesium) can be programmed at any one time and determined automatically in concentration ranges of from 0.01 to 100 per cent.

GENERAL

Since their founding over 50 years ago, Yorkshire Engineering Supplies, Limited, at Upper Wortley Road, Leeds, have achieved an enviable record as manufacturers of high-duty bronze castings. The firm now employs about 500 people in the main works and the two branch foundries they operate. It has been an underlying principle of the firm's board for many years to institute and maintain a policy directed to the production of quality-controlled castings. An initial step taken many years ago, was to standardize on the use of virgin metals as raw materials and this was supplemented by the service of well-equipped chemical and mechanical-testing laboratories.

Virgin metals are very expensive and where compositional control is not exceptionally efficient, it is easy to waste money. For example, if tin be incorporated in an alloy greatly in excess of the minimum specified in the Standard, it can result in an annual four-figure loss when operating a foundry on the scale of Y.E.S. The newer non-ferrous metal specifications also stipulate a low maximum content for certain minor elements. Above all, modern manufacturing conditions demand regularity in properties—including composition—of the various alloys made. At the Yorkshire firm, a serious effort has been made to solve such problems by pioneering the installing of the automatic fluorescent X-ray spectrometer, described earlier. (For those readers who have knowledge of the Quantometer instrument employed for a similar purpose, it should be pointed out that the major difference between the Solatron unit and the Quantometer is that the latter measures optical spectrum lines, while the former examines the X-ray spectrum.)

What the Machine Can Do

When the JOURNAL'S representative visited the Y.E.S. laboratory, the apparatus was busily engaged on the routine testing of gunmetal samples for zinc content at the rate of 60 results per hour. The disc-like programming device of the spectrometer was set at the zinc angle of 20.89 deg., this being the Bragg angle for that element. The electronic valves were twinkling away at different speeds and, in less than a minute, the zinc-count value was printed on a paper roll. Habitually, five tests are taken without interruption and then the counting machine averages the results, which figure is then transmitted by telephone to the firm's melting shops.

A second test witnessed was exceptionally interesting, as a sample of unknown composition was put through one channel. For this, the detector was automatically traversed commencing at a low angle, and the perturbations—or " peaks "—were recorded on a chart. When an angle representing the presence of a major component was encountered, a huge peak was shown, but for minor impurities, only a small movement appeared. Then, by reference to a table, the element corresponding to the position of each peak was revealed. If it be of sufficient interest, the magnification of the signal to the chart recorder can be amplified so as to register even minor elements prominently on the chart. The chart is so calibrated that it shows the exact qualitative composition of the metal being examined and if a perturbation represents, say, nickel is detected, then the machine can be set at that element's Bragg-angle and a test run through for an exact quantitative figure to be registered.

The laboratory staff operating the machine at the Leeds foundry wear pocket dose-meters, but the amount of stray X-ray radiation registered has always been found to be insignificant.

As a final comment, it would seem that, if the apparatus fulfils its early promise, future generations of foundrymen will wonder how scientific control could have been carried out in any non-ferrous plant before the invention and application of such labour-saving and rapid techniques.

Acknowledgment

Thanks are due to Mr. Peter B. Higgins, managing director, Mr. Brian Higgins, works director, and Mr. Dudley Nourse, director and chief metallurgist, for providing details of this apparatus for publication.

British Standards Institution

New standard BS. 3243:1960. Hand-operated chain-pulley blocks is a 19-page publication specifying requirements for rating, factor of safety, tests, marking—and certain details regarding the construction of the block. The materials used for the block (steel sections, plates and bars; castings; non-ferrous metals) are required to comply with certain specified British Standards, or alternatively, to have the essential qualities laid down in those specifications. The manufacturer is required to declare the operating effort and the velocity ratio, although limits to these values are not laid down. Guidance on the appropriate operating effort for the various classes of duty is given in an appendix. A dynamic test with one-and-a-half times the safe-working load is required; and there is an optional static test involving the application of twice the safe working load.

Copies of the standard may be obtained from the British Standards Institution, sales branch, 2, Park Street, London, W.1; price 5s.

Geo. Salter & Company, Limited

Visit to the Foundry during the Bicentenary Celebrations

Whilst participating in the bicentenary celebrations of this famous old company, the advantage was taken of inspecting the foundry. This is quite separate from the main works and is by no means as old as the parent company. According to the foundry manager, the manufacture of castings has been undertaken for about 75 years. The chief activity of the foundry is to supply the company's main works with repetition castings, and as most of these are built into machines for domestic use, they have to be—and indeed are— of impeccable surface-finish. In addition, orders are regularly received for some of the more intricate castings required by the automobile industry.

The foundry is divided into two sections, one of which is a well-equipped pressure-die-casting foundry. In this department, using a battery of machines made by E.B.M. Company, Limited, about 5 tons of aluminium and zinc-base components are turned out weekly. Considering that the average weight of each component is of the order of 8 oz., this is no mean production. The department is staffed by mainly female labour and a serious effort is being made to eliminate those heaps of castings lying on the floor by the introduction of pallet plates and tote boxes which are handled by fork-lift trucks and a Stacatruc. Contiguous to the die-casting section are departments devoted to the machining and general finishing of the castings.

Iron Foundry

The iron foundry is semi mechanized and produces about 25 tons of castings per week. Melting is carried out in two 25-cwt. capacity cupolas, working on alternate days. This foundry was one of the first to have cupolas instrumented by John Thompson (Instruments), Limited, and excellent control is being achieved. The charts produced give a clear picture as to what is happening as the melt progresses.

There is nothing special about the sand preparation except that like all foundries which set store by surface finish, some little extravagance occurs in the use of facing sand, but this is money well spent. Whilst there is a jobbing floor for the making of larger castings, most of the work is carried out on a line of 20 moulding machines. Included in these is a Coleman-Wallwork joint/squeeze/pin-lift stripping machine which is serviced by roller pathways for the return of the Bilston steel moulding boxes—a system which will no doubt be extended. Metal is brought to the moulding section on monorails carying Roper ladles which are operated by one man. Altogether about 30 moulders are employed.

The whole of the coremaking requirements are carried out (be they small or large) by experienced female labour, from which it will be gathered that the majority of the moulds made on the machines require no cores.

The fettling shop has a Sand Wizard shotblast machine and quite a battery of double-ended grinding machines as the demand for this plant is a variable, depending on the type of castings being produced in quantity. An important plant installed in this department is an oil-fired furnace by Lucas, Birmingham, which is used for the heat-treatment of castings. The cycle normally applied is 2 hours at 750 deg. C.

Patternshop and Despatch

The foundry is serviced by a well-equipped patternshop, staffed by two men dealing with wood patterns, one for metal patterns and two apprentices. Very high grade patterns are made to ensure the production of large quantities of dimensionally-accurate castings for use in the company's own and customers' machine-shops. The foundry also operates its own chemical and sand laboratories. All the castings are inspected before despatch and this department is quite extensive.

Summing up, the foundry of Geo. Salter is well equipped without being highly mechanized and is completely devoted to the production of castings specially suited to later surface coatings.

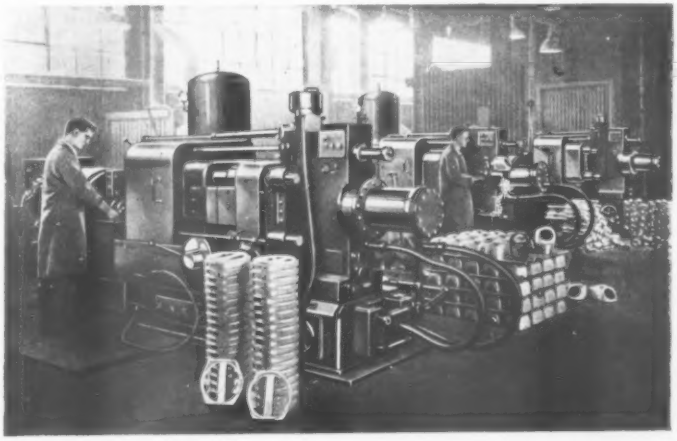


FIG. 1.—*Battery of pressure-die-casting machines at the West Bromwich Foundry of Geo. Salter & Company, Limited.*

Ablution Centre at David Caird's

A new ablution and amenity centre at David Caird, Limited, Barrow-in-Furness, was recently opened by the Mayor of Barrow, Alderman Mrs. A. M. Tait. Using an existing building, the centre has been constructed at a cost of £11,000 to take care of 200 employees. The block consists of two large changing rooms (with 200 lockers in each) arranged on the now normally accepted layout, whereby one room is kept for outdoor clothes and the other for working clothes. Adjacent to the changing rooms are showerbaths and wash-basins (Fig. 1) and here the walls are white tiled and the floors and skirting red tiled. An ambulance room is provided where all necessary equipment is at hand to render first-aid. Both the water and air temperature are thermostatically controlled, the heat being provided by an underfeed coal-fired boiler. The heat from this boiler is also utilized to warm the employees' canteen, adjacent to the ablution centre, as well as to keep constant the air and water temperatures in dining and changing rooms which have been provided as a separate unit for the outside staff.

The provision of these facilities is part of a comprehensive modernization scheme which has been going on at the works of David Caird for a number of years. The scheme includes completely new fitting shops, machine-shops, extension and mechanization of the foundries, and construction of a new 20-ton per hr. melting unit which came into operation in July last year. The latter incorporates the latest features in handling devices and, in particular, a system of coke feed designed by the company, whereby all coke entering the works is entirely automatically handled, so that the weighing of the coke and adding it to the cupola charge is carried out with very little expenditure of human effort.

During the opening ceremony, which was attended by many local dignitaries and industrialists, Union and Factory Inspectorate officials, the present chairman and managing director, Mr. D. A. While, mentioned that the company had been in existence since 1884, and was now one of the largest manufacturers of ingot-mould and iron castings in the country.

Fig. 1.—Section of David Caird's new ablution centre.

International Foundry Congress

Papers to be presented in Zurich September 19 to 24

The scientific and technical sessions to be held at the 27th International Foundry Congress in Zurich next September will be under the general heading: "Improved working conditions and technical advancement in foundries" and will fall into three groups: (I) Recent results of foundry research; (II) modern working methods in the foundry and (III) man and the foundry.

Simultaneous Sessions

The sessions will be held simultaneously in two lecture-rooms and the following papers will be presented (the paper's reference number being quoted first).

Group I

(19) "Anisotropy and Mechanical Properties of Cast-Iron," by J. S. Abcouwer (Holland).

(4) "Behaviour of Hydrogen in Cast Steel," by Prof. P. Bastien (France).

(8) "Problem of Evaluating Cast Irons and the Rôle of Secondary Grain Structure," by Dr. A. Collaud (Switzerland).

(1) "Investigations into a Metallurgical Blast Cupola (M.B.C.)," by R. Doat, H. Doutreloux and H. De Rijcker (Belgium).

(5) "Influence of Increased Lead on the Pressure-tightness of Leaded Gunmetal, type 85/5/5/5," by L. Ekbom (Sweden).

(24) "Investigations into the Properties of Moulding Materials at Elevated Temperatures," by Prof. O. Hoff, F. Hauser and Overgaard-Rasmussen (Denmark).

(23) "Light-alloy Castings produced in Aluminium Dies," by K. Maréchal (Hungary).

(11) "Gases in Ferro-alloys," by Prof. Dr. Marincek (Switzerland).

(21) "Graphite Formation in Cast Iron," by Dr. A. G. Minkoff (Israel).

(10) "Decomposition of Cementite," by Prof. Dr. R. Mitsche (Austria).

(22) "Influence of Supercooling on the Fluidity of Molten Metals," by Prof. Dr. S. Morita (Japan).

(3) "Progressive Cooling, Solidification and Transformation in Castings," by Prof. Dr. W. Patterson and W. Koppe (Germany).

(9) "Determination of the Linear Speed of Combustion of the Cupola," by C. Podrzucki (Poland).

Group II

(6) "Aluminium Castings suitable for Anodic Oxidation," by Dr. A. Bloch (Switzerland).

(14) "Shaping the Metal Stream as an Aid to the Technique of Running the Casting," by M. Bednarik (Czechoslovakia).

(16) "Production of Pearlitic Cast Iron in the Electric Furnace," by N. G. Chakrabarti, U. K. Bhattacharya, B. K. Gupta, and N. R. Mitra (India).

(15) "Further Development of the 'Buhrer' Moulding and Casting Plant," by W. Götz (Switzerland).

(7) "Quality Control of Cast Iron by Ultrasonic Testing," by A. Lehtinen (Finland).

(12) "Cost Determination in Foundries," by E. Lotti (Italy).

(17) "Mould Paints and Washes for use in the Steel Foundry," by J. M. Middleton and P. G. McIlroy (Great Britain).

(18) "Application of Sodium-silicate/Bentonite Sand Mixes without Gassing with CO_2," by Prof. M. B. Pajevic and J. Kruspel (Jugoslavia).

(*Continued on p. 821 foot of col. 1*)

Training for the Future

New Techniques suggested for the Education of Foundry Apprentices

*By C. B. Fearnside**

"Ability," "aptitude" and "interest"; these are words which are often used in the field of education and training. They represent what is probably the greatest problem in this field—the human problem involving the task of training people of widely varying talents and background. Only a comparatively small number of boys who begin courses at technical colleges successfully complete the course, many never even complete the first year. This would seem to indicate a need to tailor the course to suit the student or to tailor the student to the course.

Mention has been made in the FOUNDRY TRADE JOURNAL of a scheme whereby potential foundry course boys sit an entrance examination. Those who fail can enter a tutorial course designed to bring them up to the desired standard. What of those who do not reach that standard, should the standard be lowered? The answer must be an emphatic No!, rather let another standard be set.

Day School System

A lead might be taken from the day schools where children are divided into streams A, B, C and so on according to their "Age, Ability and Aptitude." In the case of technicians the "A" stream would consist of boys who would be likely to reach the advanced grade of City and Guilds examinations in the prescribed time and at the same time reach a good standard in foundry metallurgy or chemistry and physics. The aim could be to achieve entrance qualifications for the National Foundry College. Such a course might be known as the "Technician's Course."

The "B" stream or "Foundryman's Course" would demand a lower standard for entrance and would aim at a standard equivalent to the Ordinary grade of City and Guilds. Complete mobility would be allowed between the two streams so that a boy whose work in the "B" stream reached a sufficiently high standard could be transferred to the technician's course and, of course, *vice versa*. Those apprentices, who for a variety of reasons did not initially qualify academically for either the technician's or foundryman's courses, would take the moulder's course with freedom and encouragement to qualify and transfer to the more advanced courses.

Lack of "Writing" Ability

A possible reason why some boys would be initially placed on the moulder's course would be their lack of practice and experience in expressing their knowledge in writing. With effort and co-operation between the teacher and the student this handicap can be largely overcome. Unfortunately not all boys can see the purpose, need or value of such an effort and they therefore present a further problem. Since such boys cannot be tailored to the courses as they generally stand at present, it is suggested that a course be designed which will be more suited to their standards.

Simplified Course

Probably the first point to recognize when such courses are being planned is that the boys will learn more readily by being taught and instructed rather than by taking notes from a lecturer with a view to absorbing the subject matter later in private study. The subject must be simplified and made interesting. As an aid to this end use should be made of film strips and slides, wall charts and models. Work visits could be incorporated into the courses, but to be of real benefit these must be carefully organized, and full co-operation by the management is a great help. A "walk round" in a large party must be avoided. If a visit is to cover the whole works, small parties of half a dozen or so will allow each student to hear what the guide has to say. On the other hand the same foundry may be visited two or three times in the course of a year, perhaps on one occasion to study the sand plant and another time to the melting plant, or the apprentice pattern-makers may go along to see a large pattern at different stages of construction.

In such a course the students would probably stay with the same teacher throughout the day and he would be responsible for the main subjects of the course, but specialist teachers would give physical training and talks on such subjects as factory regulations, safety, income tax and health, and others in which the boys have a direct interest.

Students who are unable to express themselves fluently in writing are handicapped when sitting tests or examinations. Thus an apprentice who has quite good ability as a tradesman may put up a rather poor show when confronted with the traditional type of question which starts, "With the aid of sketches describe. . . ."

Sample Papers

The following are types of question papers which are suitable for first-year students and which may offer a solution to their problem.

First Paper

1. State the names of two non-ferrous alloys and two metals.
2. Give two likely causes of blowholes in castings.
3. Names three items of clothing or equipment which are worn for protection in the foundry.

* The author is lecturer in foundrywork and patternmaking at the School of Engineering, Burnbank, Lanarkshire.

Training for the Future

4. What are the ingredients of blackwash or wet blacking?
5. Why does CO_2 cause a certain sand mixture to harden?
6. What is meant by (*a*) permeability, (*b*) refractoriness.
7. Give a formula for finding the area of a circle.
8. Name the following (*a*) a liquid used in thermometers, (*b*) an instrument used to measure the temperature of liquid metal.
9. State three methods by which heat can be transferred.
10. Arrange the following in order of their melting point: Aluminium, cast iron and gunmetal.

Second Paper

Answer *true* or *false* to the following questions.

1. A purpose of fillets is to strengthen the casting. .....
2. Green-sand moulds are usually more permeable than dry-sand moulds.
3. A natural-bonded sand contains clay. .....
4. Steel is poured at a higher temperature than cast iron. .....
5. Plumbago can be used as a facing for green-sand moulds for steel castings. .....
6. The bottom face of an open-sand mould for a flat plate should be rammed hard. .....
7. Coal-dust is mixed with facing sand in the ratio of 1 : 50. .....
8. Oil sand should be mixed in a heavy roller mill. .....
9. A plate cast horizontally exerts a greater upward thrust than it would if it was cast on end. .....
10. Taper helps to prevent damage to a pattern during the moulding process. .....

Third Paper

Answer the following questions by placing the appropriate letter in the space provided.

1. The *cambium layer* is found (A) immediately under the bark of a tree, (B) in the heart of the wood or (C) between the annual rings. .....
2. A *rip saw* is used (A) for fine accurate work, (B) to cut along the grain or (C) to cut across the grain of wood.
3. A *standard* of timber is (A) 65 cub. ft., (B) 165 cub. ft. or (C) 565 cub. ft. .....
4. The defect known as a *cup shake* is seen as (A) separation of the medullary rays, (B) separation of the annular rings or (C) blemishes on the bark. .....
5. The machined faces of casting are preferably cast (A) at the top of the mould, (B) in the position preferred by the moulder or (C) at the bottom of the mould. .....
6. The most commonly used wood in pattern-making is (A) mahogany, (B) red deal or (C) yellow pine. .....
7. The natural tendency in a plank exposed to the atmosphere is for (A) the annual rings to straighten, (B) the plank to stretch lengthwise or (C) the plank to bend in the middle. .....
8. The rim of a pulley wheel would generally be constructed (A) by cutting it from a solid piece of wood, (B) by using lagging or (C) by building up segments. .....
9. A solid cylinder when being turned in the lathe would be held (A) between centres, (B) on a face plate or (C) in a bell or cup chuck. .....
10. Patterns for steel castings would be given (A) no contraction allowance, (B) a greater allowance than for cast iron or (C) the same allowance as for cast iron. .....

Japanese Foundry Conference

The illustration below shows a meeting of the Japanese Foundry Technical Association at which Mr. Mario Olivo—the well-known Italian foundryman—received the honorary membership of the Japanese Foundrymen's Society. During the course of the proceedings Mr. Olivo delivered two lectures, speaking in English. The picture was taken in the University of Nagoya last month.

IBF Malvern Conference

At a total of 575 registrations and an attendance at the banquet of close on 500, the annual conference of the Institute of British Foundrymen held at Malvern over almost the whole of last week can be described as an unqualified success. Fine weather for the most part, technical sessions reasonably well attended, works visits running smoothly, better-than-ordinary banquet speeches and organization of high order all contributed to make it a conference which will be looked back on with pleasure for many years.

The proceedings commenced in Malvern on Monday, June 20, with Council and committee meetings, followed by the assembly of the whole of the general conference delegates and their ladies in Dudley (on the edge of the Midlands industrial area) on Tuesday for lunch. This preceded, for the menfolk, the first series of works visits which occupied Monday afternoon (the second series of works visits occupying the whole of Thursday). For the ladies that afternoon and in fact during the whole of the week, sightseeing excursions, etc., were arranged. On Tuesday evening, there was a civic reception and dancing at the invitation of Malvern Urban District Council. The Wednesday morning was devoted to the annual general meeting, when the new president, Mr. G. R. Shotton F.I.M., was formally inducted. This was followed by the presentation of awards and the Edward Williams lecture, with the annual banquet in the evening. The latter was a brilliant function, notable for a most inspiring speech from the chief guest, the Marquess of Exeter (chairman of Birmid Industries, Limited). The technical sessions of the conference were held in two assembly rooms simultaneously during the Wednesday afternoon and again all day on the Friday. These and the social events were centred on the Winter Gardens, Malvern, the catering being looked after by the Birmingham City Corporation the whole proving an admirable arrangement. At the Winter Gardens, also, the closing informal dinner of the conference was held on Friday.

Naturally, it will be some little time before the whole value of the conference, papers and discussions can be assessed, but everything tends to show that when full reports are available, the whole membership of the Institute will have reason to endorse the statement made earlier and congratulate the organizers (the Birmingham branch and the IBF head office secretariat) on the success of the whole proceedings. (A full account of the conference, with illustrations of a few of its "highlights", will appear in an early issue of the JOURNAL.

International Foundry Congress

(*Continued from page* 818)

(13) "Grain Refinement of Cast Metals," by Prof. J. F. Wallace, Prof. E. W. Form, G. Gould, G. K. Turnbull and K. Merchant (USA).

(20) "Electric Melting in the Foundry," by Dr. E. Zingg (Switzerland).

Group III

(2) "Peaceful Co-operation in the Swiss Engineering and Metal Industries," by Dr. H. Schindler (Switzerland).

HOOVER, LIMITED—Mr. Oscar M. Mansager has been appointed deputy chairman. He is a director and executive vice-president of the US parent company and has been a director of the UK company since 1954.

Berne Union Annual Meeting

Delegates from export credit insurance organizations in 17 countries attended the 17th annual general meeting of the *Union d'Assureurs des Crédits Internationaux* (the Berne Union) which was held in Seville, Spain, from June 6 to 9.

The Canadian president of the Berne Union, Mr. H. T. Aitken, presided at the discussions which consisted of a review of each member's experience in and attitude towards various markets, consideration of the general economic outlook in the importing countries, and the question of credit terms of payment for both consumer and capital goods. Technical underwriting questions were also considered.

It was re-emphasised that Berne Union members, in providing cover for their exporters against non-payment by foreign buyers for goods and services, follow the custom of the trade as practised internationally with regard to the credit terms of payment for various categories of goods. Credit insurance is granted for consumer goods which are generally sold on credit terms of up to 180 days. Where credit insurance for capital goods is required, Berne Union members confirmed their view that the maximum credit period after delivery for even large contracts should not be more than five years.

The conference also was of the opinion that reasonable commercial practice called for adequate down-payments before shipment in all cases where medium-term credits were covered. Mr. L. J. Menzies, of the UK Export Credits Guarantee Department, was elected president, and Mr. A. Thomas, of the *Office National du Ducroire*, of Belgium, vice-president. The next annual meeting of the Berne Union is to be held in Vienna, Austria.

Washing Facilities in Factories

From August 1 factory owners and occupiers in Great Britain will have to include running hot and cold or warm water among the facilities for washing for workers employed by them under an Order—the Factories Act, 1959 (Commencement No. 2) Order, 1960—made by the Minister of Labour on June 21.

At the same time the Minister has laid before Parliament the Washing Facilities (Running water) Exemption Regulations, 1960. These exempt until August 1, 1961, all factories employing five workers or less from the requirement to provide running water for washing for factory workers. They also empower district inspectors to grant exemptions for factories in the circumstances specified in the Regulations.

Under the Draft Washing Facilities (Miscellaneous Industries) Regulations, 1960, also published on June 21, orders and regulations which have been made from time to time under the Factories Act containing special provisions relating to washing facilities, but not this latest provision about running water, are brought into line with Section 18 of the 1959 Act.

Foundries operate under special regulations but this order will affect patternmaking establishments.

THE HEAVY PLANT DIVISION of Associated Electrical Industries, Limited, has contracts for rolling-mill drives valued at nearly £500,000 and totalling 14,000 h.p. from steel companies. A motor to half this horsepower is to be installed in the Stocksbridge, Sheffield, works of Samuel Fox & Company, Limited. The other orders are from the Head Wrightson Machine Company, Limited, and the South Durham Steel & Iron Company, Limited.

Equipment & Supplies

Magnetic Separator

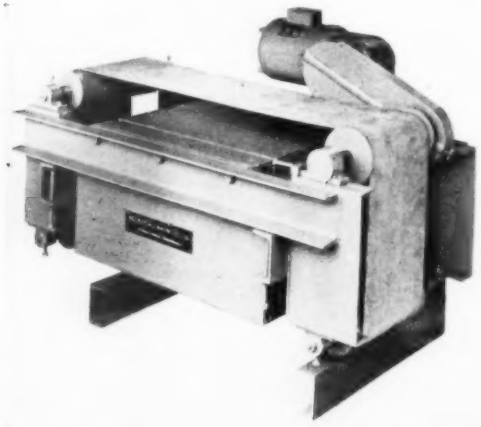
Industrial Magnets, Limited, Station Road, Acocks Green, Birmingham, 27, announce the introduction of an entirely new range of high-intensity electromagnetic separators (Fig. 1) specially designed for the extraction of feebly-magnetic particles from silica sands and like materials which are travelling on existing conveyors, and which involve no alteration to the plant on installation. The separator is built as a completely self-contained unit, in a series of sizes to cover a range of conveyors from 12 to 48-in. wide, and only requires supporting "stringers" on installation.

The separator operates on a cross-belt principle. A robust framework carries a high-permeability steel-magnet unit with totally-enclosed high-conductivity copper magnetizing coil. The cross-belt passing along the magnet poles immediately over the main conveyor burden, searches and extracts magnetic particles from material being processed and provides automatic discharge. A number of these separators can be installed over the same conveyor, each unit having individual adjustment for the working gap, thereby enabling particles of different magnetic susceptibility to be extracted by each unit. Rheostatic control for magnetic intensity can also be arranged. The separator, which is claimed to be virtually maintenance free, includes a totally-enclosed geared motor and chain drive. The unit is so designed as to permit easy belt replacement.

Dust-collector Cabinet

Bellanger Bros. (London), Limited, 306, Holloway Road, London, N.7, announce that they have placed on the market a new design of dust-collector cabinet, embodying a new principle of dust separation. Instead of the usual multiple filter-bags or sleeves, the new model—known as "Bellbro"—is fitted with filtration panels made of a porous plastic material of patent design, which offers a minimum of resistance to airflow, yet traps the dust effectively. This enables the motorized fan to maintain its original efficiency. The ½ h.p. motorized fan unit drives a 10-in. dia. impeller running at 2,850 r.p.m., giving a displacement of free air up to approximately 700 cub. ft. per min., with a pressure up to approximately 4.5 in. s.w.g. The new unit is light in weight and easily transportable and can be installed adjacent to the dust-producing machines. It is stated that the high filtration efficiency of the unit allows the conveying air to be discharged clean and upwards to avoid draught and with no loss of heated air, thus obviating the necessity of exhaust ducting. The filtration panel elements are easily withdrawable through a quick-release panel in front of the cabinet and are largely self-cleaning and require no shaking gear or other mechanism. When required, the elements can be removed for cleaning and after considerable use can be washed in lukewarm water. A primary dust tray is arranged at the base of the cabinet and this is easy to remove for emptying. A push-button starter with overload protection is fitted to the cabinet and all internal connections are made so that they only require wiring up to the mains switch. The cabinet is 35-in. high, 20-in. wide and 20-in. deep and weighs approximately 1½ cwt.

FIG. 1.—*High-intensity electromagnetic separator for extracting feebly-magnetic particles from sand. (Industrial Magnets, Limited.)*



Diverter Valve

A diverter valve which can be supplied for either manual or electro-pneumatic operation is now being manufactured by Thomas Robinson & Son, Limited, Rochdale. The valve has been designed for use in the company's Pneu-Flow pneumatic-conveying system, for diverting powdered or granular material such as core or moulding sand in blowing lines. The valve can be supplied in various bore sizes, and single solenoid valves with spring returns, or double solenoid valves which can remain in either position indefinitely, are available.

The valve consists of a cast-iron casing with an inlet bore and two outlet bores, the latter dividing at an angle of 40 deg. A piston, located axially by end-caps, and radially by a stud, is fitted in the cylinder. The piston has two ports and by changing its position in the cylinder the conveying air and stock passes through either one or the other to the appropriate outlet bore. The piston is moved by compressed air at 60 lb. per sq. in., admitted through the end-caps. A piston valve, electrically operated by a solenoid, admits compressed air from the air-line to the required cylinder-end, and in the same operation exhausts the air from the opposite side of the cylinder. Micro switches can be fitted to the cylinder cap ends to provide visual or audible indication that the piston has moved to one or the other position, or to incorporate the valve into the plant control system for the operating sequence. Tie rods, which clamp the end-caps to the cylinder ends, are used to mount the valve in any required position on the supporting steelwork. Provision should be made in the compressed air line for adequate water-traps and oil lubricators.

Standard Unit Dies

A unit-die construction made by Detroit Mold Engineering Company, 6686 E. McNicholls Road, Detroit, Michigan, USA, is now available as a standard assembly for zinc die-casters. It is claimed that this will enable die-casters to replace "short-run" cavities in a matter of minutes, and with a minimum of cost. The design permits complete freedom on three sides of the cavity for replacement of cores of cooling lines, the twin replacement units being a standard size (9⅞ by 11⅞ in.). The complete assembly (D-M-E Standard Unit Die) (see Fig. 2), includes: a unit die-holder with water-cooled sprue bushing; sprue

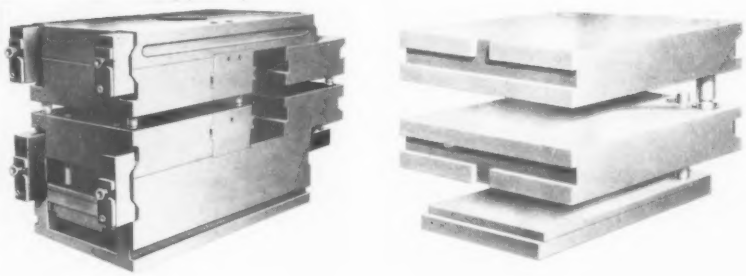


FIG. 2.—*(left) D-M-E Standard Unit die holder with replacement units installed, showing wedge clamps on one end, and the opposite end in the semi-removed position; (right) the replacement unit, which has key slots machined into mating face of the cavity plates. (Detroit Mold Engineering Company, USA).*

spreader; leader pins and wedge clamps; either rack-and-pinion or "bumper-type" ejector-box assembly; set of matched unit-die blacks with leader pins; ejector plates, and return pins.

The assembly has six leader pins and bushings—two in each unit die and two permanently installed in the unit-die holder. The replacement unit-die blocks may be accurately located in the unit-die holder by means of a milled T-slot in the edge of the plates, and are held firmly in position by a pair of "quick-change" wedge clamps. The standard unit-die holder is available with a rack-and-pinion type ejector-box, which contains two parallel pinions geared to activate six heavy-duty racks simultaneously for balanced ejection. An optional feature is separate core-retainer plate assembly, which permits the use of ejector sleeves when this type of ejection is required. An alternative design provides a plain "ejector housing," which accommodates the hydraulic or "bumper-type" of ejection.

Worm-gear Jacks

A new standard range of worm-gear jacks, known as the Duff Norton 1800 series, has been introduced by the Consolidated Pneumatic Tool Company, Limited, of 232, Dawes Road, London, S.W.6. The range consists of 8 units with capacities of from 2 to 100 tons and has been specifically designed for building into machinery and equipment where jacking duties are involved. Being mechanical in operation, the jacks can be connected by means of shafting and mitre gearboxes to lift in unison, even with an unevenly distributed load. They are self locking and it is claimed they can be used to hold loads of several hundred tons in position indefinitely without creep occurring. Features common to all jacks in the range include the use of heat-treated phosphor-bronze worm-gear teeth, and the absence of keying in the lifting screw, allowing the top to be bolted to the member being raised. A clockwise rotation is employed for lifting the load, the maximum worm-gear speed being 500 r.p.m. The closed height of the range lies between 5¼ in. for the 2-ton model and 24 in. for the 100-ton unit.

Protective Face Screen

Safety Service Company, Limited, "Itex" House, Wendover Road, Harlesden, London, N.W.10, announce the marketing of the Monogard—a swivel face-screen protector, claimed to the be first of its kind to be placed on the British or European markets. Providing full facial protection, it is so designed that it will not permanently mist up under any conditions, does away with the "shut-in" feeling common with goggles, spectacles and screens and permits an uninterrupted field of vision. These features are obtained by supplying a combined phosphor-bronze mesh and (replaceable) plastic visor.

The model can be fitted with a clear screen for general protection against flying particles or chemical splashes; a green anti-glare screen for light reduction, and either GW1, 2, 3, or 4 for gas welding operations.

It is expected that operators will appreciate the adjustable cushioned head-harness and overall light weight of the shield which will fit over even the largest spectacles.

Loader: E. Boydell & Company, Limited, of Old Trafford, Manchester, have announced that the Muir-Hill 2W1 Mark II loader, introduced last year, is now available equipped with the Sherman hydraulic-power digger or trencher. A hydraulic pump in the digger unit is driven by an integral hydraulic motor which in turn takes its power supply through a pair of flexible hoses with self-sealing couplings from the hydraulic system of the loader. The provision of a four-pin attachment it is said enables the power digger to step off the loader under its own power within a few minutes and to step back into position equally quickly, whilst connected with the loader only through the flexible hoses.

New Names for Alloys: Henry Wiggin & Company, Limited, Thames House, Millbank, London, S.W.1, announce that: Incoloy DS is the new name for the alloy previously known as Nimonic DS (a nickel/chromium/iron alloy, useful in oxidizing conditions at temperatures up to 950 deg. C.), and Valray 1 is the new name for BAC Brightray (an 80/20 nickel/chromium alloy used for the coating of automobile exhaust-valves).

Machinable Refractories. W. & C. Spicer, Limited, The Grange, Kingham, Oxon, have for some time been supplying Zirconite—a machinable form of zircon silicate requiring no subsequent heat-treatment. The company now announces that they are marketing machinable alumina and silicon carbide, made in the form of bars, slabs and billets, and requiring no further firing after machining.

Quenching oils: containing Quenzine, a formulation of wetting oils and other ingredients developed in the USA by Aldridge Industrial Oils, Inc., are now being made and marketed in this country by the Electric Resistance Furnace Company, Limited, "Netherby," Queens Road, Weybridge, Surrey. These oils are claimed to give greater hardness to oil-hardening steels and to provide a deeper case quicker and with minimum distortion, oxidation and sludging.

Personal

Mr. L. P. SIMPSON, works manager of Baker Perkins, Limited, has been appointed a director.

Mr. J. L. DICKINSON has been elected to the board of Skefko Ball Bearing Company, Limited. He will continue as secretary.

Mr. WILLIAM D. PUGH, of the English Steel Corporation, Limited, Sheffield, is back in this country after a month's tour of the United States and Canada.

Mr. TOM C. FIRTH has been elected chairman of Brightside Engineering Holdings, Limited. He replaces Mr. AMROSE FIRTH who has resigned for health reasons.

Mr. S. A. ROBERTS, managing director of B.S.A. Tools, Limited, has been appointed a director of the parent company, Birmingham Small Arms Company, Limited.

Mr. KENNETH WEST, senior lecturer in engineering at the Sheffield College of Technology, has been appointed principal of the Falmouth Technical College, Cornwall.

Lord DUDLEY GORDON is to retire as chairman and from the board of J. & E. Hall, Limited, on September 30. He will also retire as president of Hall-Thermotank, Limited.

Mr. WILLIAM G. GUDE has been appointed Editor of *Foundry*, American contemporary of the JOURNAL. He replaces Mr. FRANK G. STEINEBACH who now occupies the position of publisher and editorial director.

Mr. C. W. ALLIN has resigned from the board of Redler Industries, Limited, and its subsidiary companies. He was joint managing director of Redler Conveyors, Limited, and Conveyors (Ready Built), Limited.

Mr. F. G. HOWSON has been appointed director of J. P. Hall & Sons, Limited, pump makers, Peterborough, to succeed Alderman GEORGE C. HALL who is retiring from the post but has been appointed to the new position of president.

The following have been elected to the board of the Barrow Haematite Steel Company, Limited, Barrow-in-Furness:—Sir W. HUNGERFORD POLLEN, Mr. E. G. WINDSOR, Mr. P. C. WINDSOR, Mr. W. MCCOLL DODDS and Mr. R. D. FOX.

Mr. WILLIAM A. SMITH, B.SC., A.R.C.S.T., F.I.M., has joined the firm of R. B. Tennent, Limited, rollmakers of Coatbridge, as assistant managing director. Mr. Smith was formerly with Stewarts and Lloyds, Limited, Tollcross Works, Glasgow.

Mr. K. P. H. JEENS has been appointed manager, oil industries department, at the London office of Worthington-Simpson, Limited, Queen's House, Kingsway. Mr. Jeens was until recently with Stone & Webster Engineering, Limited, when he was pump and compressor engineer.

Miss M. NEVARD has been appointed a full-time research assistant in the Department of Metallurgy by Sheffield University Council. The appointment of a woman to a post in a technological department is comparatively rare. Miss Nevard is a graduate of Cambridge University.

Mr. T. H. KELSEY, assistant general manager of the Witton Engineering Works of the General Electric Company Limited, since October 1958, has been appointed deputy general manager to Mr. J. J. Gracie, director of the company, and general manager of Witton Engineering Works.

Mr. DAVID C. HANEY has been appointed managing director of the International Harvester Company of Great Britain, Limited. He succeeds Mr. O. G. Voss who recently returned to the US to take up a position with the parent company.

Sir RALPH SORLEY, 62-year-old deputy chairman and managing director of de Havilland Propellers, Limited, and a director of de Havilland Holdings, Limited, retires at the end of this month. He will be succeeded as managing director of de Havilland Propellers by Mr. H. G. STURGEON, the deputy managing director.

Mr. S. N. KINSLEY, deputy secretary of the research and development department of the United Steel Companies, Limited, Sheffield, has been appointed secretary to the department in succession to Mr. GEORGE H. DAVISON who retires to-day. Mr. Davison, who continues to serve in a full-time advisory capacity for the time being, has been with the company for 27 years.

At a recent meeting of the Council of the British Welding Research Association, Mr. J. D. D. MORGAN and Dr. L. M. WYATT were appointed to the research board. Mr. Morgan is with the general chemical division of Imperial Chemical Industries, Limited, and is the chairman of the ICI welding panel. Dr. Wyatt is chief metallurgist of the Central Electricity Generating Board.

Mr. C. W. TAYLOR has joined the headquarters staff of Firth Cleveland, Limited, as assistant to Mr. G. HARRIES, company secretary and group chief accountant, at the Firth Cleveland group headquarters, Stornoway House, Cleveland Row, London, S.W.1. Mr. Taylor was previously secretary of Richard Hill, Limited, and Richard Hill Rolling Mills, Limited, of Middlesbrough, both of which companies are members of the group. His place at Middlesbrough has been taken by Mr. ELSDON HAILS.

Mr. J. M. SURRALL, general commercial manager and director, Simplex Electric Company, Limited, Broadwell, Oldbury, has retired after 57 years with the company. He joined when it was known as the Simplex Steel Conduit Company in 1903, and was manager of the heating and cooking-appliance department, 1912-1920. He became sales manager of the firm when reorganized as the Simplex Conduit Limited, and subsequently became a director of Simplex Electric in 1947.

Newly elected Sheriff for the City of London is Mr. ADAM K. KIRK. Born in 1893 in Balranald, New South Wales, Australia, Mr. Kirk founded in 1919, in London, the firm of Kirk & Company (Tubes), Limited, which with its subsidiaries is engaged in heavy engineering work for the oil, gas, electricity and atomic industries. Mr. Kirk is a Freeman of the City of London, and a Liveryman of the Worshipful Companies of Founders, Poulters and Joiners. He is also a member of the Institute of British Foundrymen, the Institute of Metals, and the Institute of British Engineers.

Mr. ERIC PERRIN, who has represented our sister journal, *Iron & Coal Trades Review*, in the North-East of England for the past 16 years, retires today (Thursday). For almost the whole of this time he was responsible for an area stretching from Cambridge to the Border. He made, in that period and earlier, a vast number of close friends, including many in the foundry trade. All his many associates and acquaintances throughout the country, not least the directors of Industrial Newspapers, Limited, and his colleagues at John Adam House, will wish him many long years of happy retirement. (His present address is 55, Davison Avenue, Monkseaton, Northumberland.)

News in Brief

AN EXTENSION has been made to the service depot of Wolf Electric Tools, Limited, Strathcona Street, Glasgow, the estimated cost of which was £10,000.

THE RHODESIAN IRON AND STEEL COMPANY'S works 11 miles away from Que Que, Southern Rhodesia, will start making sheet and light plate by the end of 1960 or early 1961.

ANOTHER MILESTONE in British Railways £1,660,000,000 modernization plan was completed on June 17 with the opening of a diesel-locomotive repair and overhaul depot at Neville Hill, Leeds.

GENERAL REFRACTORIES, LIMITED, held their sports day for employees of their Wharncliffe and Lowood works at their Deepcar sports arena on Saturday, June 25. There were prizes valued at over £60.

THE KETTERING (NORTHANTS) engineering firm of Charles Wicksteed & Company, Limited, are proposing to extend their iron foundry in Digby Street, and have submitted the necessary plans to the Town Council.

BASED on a recently-completed industrial laboratory, a new organization for the development of all kinds of belting has been set up by the Dunlop Belting Division at the company's factory at Speke, near Liverpool.

IN THE CHANCERY COURT last week, Mr. Justice Buckley dismissed by consent, petitions for the compulsory winding up of Wright & Platt, Limited ironfounders, engineers' patternmakers, etc., of Edgbaston, Birmingham.

MR. E. WARREN, works director, William Green & Company (Ecclesfield), Limited, ironfounders, Sheffield, at the annual prize-giving of the angling section of the firm's sports club on June 24, presented the prizes, which in all were worth more than £90.

AN ORDER worth approximately £25,000 for their super-duty firebricks has been secured by Morgan Refractories, Limited, of Neston, Cheshire, from the Broken Hill Proprietary Company, Limited, Australia. The bricks will be used to line part of the stack of a blast furnace.

THE STEETLEY COMPANY'S dolomite works at Cadeby, near Mexborough, were visited on June 22 by a party of Russian engineers and technologists touring industry in this country under an arrangement with the Refractories Association. They went to the Steetley magnesite works at West Hartlepool on June 24.

ACCORDING TO PRELIMINARY FIGURES released by the South African Department of Customs and Excise, export of uranium oxide and other materials prescribed under the Atomic Energy Act totalled £19,984,261 during the first five months of 1960, as against £20,851,188 in the corresponding period last year.

SPEAKING about the factory building programme of the Ulster Government at a meeting in London of the Northern Ireland Development Council, Viscount Chandos, chairman of the Council, said that five factories in Northern Ireland were now ready for occupation and five more were nearing completion.

A PORTUGUESE INDUSTRIALIST is reported by Barclays Bank D.C.O. to have recently visited Jos with a view to the establishment of a tin-smelting plant and the formation of a company in Nigeria to be called the Nigerian Embel Tin Smelting Company, Limited. The cost of such a plant would be in the region of £500,000.

CONTRACT for the design and construction of new factory premises for Aveling-Barford, Limited, on the Newburn estate, Newcastle-upon-Tyne, has been awarded to Taylor Woodrow Construction, Limited. The work will start in July and is expected to be finished next March. On an eight-acre site, a factory and office floor will initially cover 55,000 sq. ft.

FORMATION OF A NEW COMPANY, Stratoflex (U.K.), Limited, with a factory at 11, Colquhoun Avenue, Hillington, Glasgow, for the production of aircraft and industrial flexible hoselines, and related fluid power products, is announced by Stratoflex Inc. (USA). The managing director will be Mr. T. G. Preston. Stratoflex has factories in both America and Canada.

DAMAGE ESTIMATED AT £450 was caused by a fire which broke out in the patternshop at Rutland Foundry Company, Limited, Albert Street, Ilkeston. The fire involved a number of wooden patterns and about seven tons of bagged coal-dust. The patterns were damaged and more than half of the coal-dust lost. Arrangements have been made to carry on business as usual.

WHEN ISCOR'S present £56,000,000 expansion and modernization programme is completed in a year or two, the annual capacity of the corporation's "offshoot" at Vanderbijlpark, South Africa, will be 1,250,000 ingot tons—over half the corporation's total capacity. This is said to be a remarkable development since the Vanderbijlpark works did not reach the production stage until 1952.

P.G. ENGINEERING, LIMITED, Stockton-on-Tees, have recently signed contracts worth £1,000,000. The orders include a gasholder to be built at the Scunthorpe works of John Lysaght, Limited, and two gasholders for Richard Thomas & Baldwins, Limited, to be made by Ashmore, Benson, Pease & Company, Limited, an associate of P.G. Engineering. Another order is for a gasholder to serve in a factory in India.

ACCOMMODATION for Baker Perkins' foundry sales department has been provided in a new office-block opened recently at the company's Bedewell division works at Hebburn-on-Tyne. The new building is on two floors and is linked to the existing offices. In addition, accommodation has been provided for a reception hall, executive offices, conference rooms and the laundry sales and personnel departments.

MIDLAND ALUMINIUM, LIMITED, of Wolverhampton, has acquired a large two-bay factory and office block belonging to Coseley Buildings, Limited, on land adjoining Seisdon Rural Council's industrial estate at Wombourn. The Wolverhampton firm, whose works in Pelham Street, Wolverhampton, are in an area scheduled for residential purposes, expects to begin moving to Wombourn by the end of the year.

CRAVENS, LIMITED, railway-stock builders, Darnall, Sheffield, have been awarded a further £4,000,000 contract by London Transport Board for "Silver Trains" for use on the underground system. The new order is for 27 trains similar to those for which the firm was awarded a contract in 1959. They have lightweight aluminium bodies. Specialist contractors will carry out the part of the contract for electrical apparatus.

A £2,500,000 CONTRACT for a complete oxygen steel-making installation at the John Lysaght's Scunthorpe Works, Limited, is announced by the Wellman Smith Owen Engineering Corporation, Limited, collaborating with Voest AG, of Austria. The plant is designed initially for the production of 400,000 tons of ingots a year with provision for extension to 800,000 tons. This is the third major oxygen steel-making installation placed with Wellman Smith and Voest.

AT THE CARGO FLEET PIPE WORKS of Cochranes (Middlesbro') Foundry, Limited, recently, some tar caught fire in the 150-ft.-long shed where cast-iron

News in Brief

pipes are dipped and there was an explosion. Fire spread quickly along the ground where tar had run, but Middlesbrough Fire Brigade prevented the fire reaching cylinders of oxygen, and a large tank of several hundreds of gallons of tar was also saved. A spark from an oxy-acetylene burner falling on to hot tar is believed to have caused the fire.

HEAD WRIGHTSON STOCKTON FORGE, LIMITED, a subsidiary of Head Wrightson & Company, Limited, Thornaby, have secured an order worth nearly £250,000 for the supply of six rotary dryers to Richard Thomas & Baldwins, Limited. They are for use in an iron-ore drying plant, three being intended for the Redbourne Works and three at the Spencer Works of the company. Each installation is capable of handling a weekly output of 21,350 tons of ore and the machines are believed to be the most highly instrumented of their kind in this country.

THREE TYPE 12 FRIGATES are now being built for the South African Navy in Glasgow shipyards, and will be the last warships to be added to the South African fleet in terms of the Simonstown agreement. The first frigate, "President Kruger," should be completed in March, 1962; the second is expected to be handed over towards the end of that year, and the third during 1963. Of the Whitby class, they are primarily designed for the location and detection of submarines, and will be fitted with the latest underwater detection equipment and anti-submarine weapons.

A CONTRACT to build and operate the biggest tonnage oxygen plant serving the iron and steel industry in Western Europe has been placed with British Oxygen Gases, Limited, by the Steel Company of Wales, Limited. The plant, which is to be installed at the Margam Works, will have a capacity of 566 tons of oxygen per day, and is scheduled to come into operation by January, 1962. Costing well over £1,000,000, the plant will enrich by 4 per cent. a total blast volume of 200,000 cub. ft. of air per minute. Final oxygen content of the enriched blast will thus be 25 per cent.

A MEMORIAL to Mr. Sidney Gilchrist Thomas and Mr. Percy Carlyle Gilchrist is under erection at the premises of Daniel Doncaster & Sons, Limited, on the site where the two men, who revolutionized steelmaking, carried out their first experiments. The memorial, which will be unveiled on July 6 by Mr. G. H. Latham, president of the Newport (Mon) and District Metallurgical Society, who commissioned the memorial, is in the form of an obelisk with a bust of Sidney Gilchrist Thomas surmounting it. A trust fund for scholarships for metallurgical students has also been set up in his honour.

A NEW COMPANY, Alcan Enfield Alloys, Limited, has been formed jointly by Aluminium, Limited, of Canada, and Enfield Rolling Mills, Limited, Middlesex, to acquire the secondary aluminium smelter at Bradford, Yorkshire, at present operated by Enfield Rolling Mills (Aluminium), Limited. It will have an issued capital of £500,000—half owned by Aluminium, Limited, and half by Enfield Rolling Mills, Limited—and will produce from scrap and primary aluminium a large range of foundry alloys not normally produced at the primary aluminium smelters of Aluminium Company of Canada, Limited, the principal subsidiary of Aluminium, Limited.

"WE ARE APPROACHING A NEW ERA for the gas industry which I hope will prove the most progressive of all," said Mr. H. Butters, a member of the North Western Gas Board to the North Western Women's Gas Federation conference on June 23. He went on, "We are only just beginning to sell central heating and people are slow to change their habits, but we are now offering a system that can be installed in many homes." Mr. Butters stated that the era of "one fire in the living room and an occasional extra fire in the lounge in British homes in winter" was coming to an end. In a few years' time, he said, no homes would be built without central heating.

THE SIXTEENTH FERRO ENAMELS "refresher course" for vitreous enamellers was held in Wolverhampton in May, during which the following papers were presented: "Furnaces and Equipment for Enamelling," by Mr. T. M. Lees; "Corrosion Resistance of Enamels," by Mr. A. W. Murdoch; "Low-pressure Spraying Technique," by Mr. T. B. Vaughan; "Method of Preparation of Microspecimens," by Mr. F. G. Morriss; "Enamels for Ferro Direct Process," by Mr. A. T. Issitt, and "Metal Preparation and Ferro Direct-on-white Process," by Mr. A. H. Symonds. Copies of the papers can be obtained from Ferro Enamels, Limited, Ounsdale, Wombourn, Wolverhampton.

BRITISH WATERWAYS' new line of container traffic, "is going really well," said Sir Reginald Kerr, in a tape-recorded speech at the summer rally of members of the Northern Waterways Association at York on June 23. He added, "I think there is a big future for it." Sir Reginald said this was part of the strenuous effort made to replace the amount of coal traffic lost, by other freight. Container traffic was intended to attract small articles that were not economical to load direct into the boats. Under this scheme, small packages could be put into the containers in the factory, easily transported by road to the waterhead, and then by their boats to the ship. The containers could then be lifted on to the ship as deck cargo.

Obituary

The death has occurred of Mr. CHARLES WAINWRIGHT, a chargehand for 31 years with C. & J. Hampton, Limited, toolmakers, Sheffield.

Mr. CHARLES H. SITCH, formerly an M.P., who has died at the age of 73, was for many years secretary of the South Staffordshire Chainmakers and Chain-stretchers' Association, of which his father was a founder-member and secretary for 34 years.

MR. KARL FREDRIK GÖRANSSON, chairman of Sandvik Steelworks from 1939-1959, and grandson of Mr. G. F. Göransson, the first man to successfully exploit on a commercial basis the Bessemer process of steelmaking, died in Sweden on June 13. Mr. Göransson was a director of *Jernkonteret* (the Swedish Ironmasters Association) from 1928 to 1949; and chairman of the Swedish Federation of Industries, 1939-1942. He had also been president of the Swedish Academy of Science and a member of the Scientific Society of Upsala.

Mr. J. M. RIMINGTON, managing director of the chemical division of the Distillers Company, Limited, London, W.1, died on June 19 after a long illness. Mr. Rimington was one of the original employees of British Industrial Solvents, Limited, a subsidiary of DCL, formed in 1929. He was promoted to company secretary of BIS in 1939, to the board in 1945, and to managing director in 1953. Four years later, on the formation of the chemical division, he was appointed division managing director. He was also on the board of five companies associated with the chemical division, and of these he was chairman of three.

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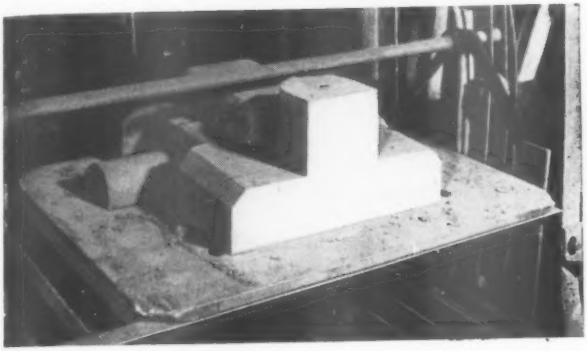

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Pig-iron and Steel Production

Statistical Summary of April Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table 1 summarizes activities during recent months. Table 2 gives production of steel ingots and castings in April. Table 3, weekly average production of finished steel in March. Table 4 gives the production of pig-iron and ferro-alloys in April, and furnaces in blast. (All figures are weekly averages in thousands of tons).

TABLE 1.—*Iron and Steel Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imported ore used.	Coke sent to blast furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	Iron and steel.	Coal.	Basic materials.[1]						Imports.[2]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[3]
1957	328	488	537	325	303	270	275	220	14	417	322	2,580
1958	343	403	478	276	262	227	245	196	9	369	284	2,242
1959	340	497	477	286	244	210	242	208	7	388	291	2,244
1960—Feb. ..	338	503	486	333	320	256	302	250	15	482	375	2,267
Mch.[4]	337	502	487	347	325	262	312	256	19	485	376	2,243
Apl. ..	337	502	490	326	329	265	311	251	23	478	370	2,289

TABLE 2.—*Average Weekly Production of Steel Ingots and Castings in April.*

District.	Open-hearth.-		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derbys, Leics, Notts, Northants, and Essex ..	—	4.6	16.6 (basic)	2.5	0.1	22.4	1.4	23.8
Lancs, (excl. N.-W. Coast), Denbigh, Flints, and Cheshire	0.7	40.6	—	5.2	0.3	45.6	1.2	46.8
Yorkshire (excl. N.-E. Coast and Sheffield) ..								
Lincolnshire	—	50.3	—	—	0.1	50.3	0.1	50.4
North-East Coast	0.7	90.3	—	1.3	0.4	91.0	1.7	92.7
Scotland	0.8	50.0	—	3.8	—	52.6	2.0	54.6
Staffs, Shrops, Worcs, and Warwicks	—	25.9	—	4.2	0.7	29.0	1.8	30.8
S. Wales and Monmouthshire	2.3	93.7	15.8 (basic)	0.8	0.1	112.3	0.4	112.7
Sheffield (incl. small tonnage in Manchester) ..	6.9	39.5	—	13.5	0.3	58.3	1.9	60.2
North-West Coast	—	—	5.3 (acid)	0.8	—	6.0	0.1	6.1
Total	11.4	394.9	37.7	32.1	2.0	467.5	10.6	478.1
March, 1960[4]	13.8	394.6	39.3	35.1	2.3	473.3	11.8	485.1
April, 1959	11.5	322.2	25.3	26.2	2.1	377.4	9.9	387.3

TABLE 3.—*Deliveries of New Non-alloy and Alloy Finished Steel*

Product.	1958.	1959.	1959.	1960.	
			March.[4]	Feb.	March.[4]
Non-alloy steel:					
Ingots, blooms, billets, and slabs[5]	4.6	5.1	4.1	5.3	5.5
Heavy rails ..	10.2	6.8	7.3	8.8	10.0
Sleepers	1.2	0.6	0.7	0.3	0.5
Fish and soleplates	0.7	0.4	0.3	0.6	0.5
Plates	47.3	43.1	42.3	53.7	54.5
Other heavy prod.	41.8	41.2	35.5	56.0	55.7
Ferro-concrete bars	7.6	9.6	7.8	13.4	12.7
Wire rods	21.5	23.5	21.1	28.9	29.9
Arches, etc. ..	8.6	7.8	8.7	8.5	8.5
Other light sections	29.1	33.0	28.5	44.5	45.5
Bright steel bars ..	6.2	7.6	6.3	10.4	10.3
Hot-rolled strip ..	22.6	27.4	26.7	36.2	35.3
Cold-rolled strip ..	7.0	8.0	7.0	10.6	10.7
Sheets, incl. uncoated:					
(i) Hot rolled ..	10.6	11.8	10.9	14.2	13.9
(ii) Cold reduced	31.1	35.2	33.3	41.3	43.5
Tinplate	18.7	20.9	18.9	26.1	24.7
Blackplate ..	0.8	0.7	0.7	0.9	1.0
Steel tubes up to 16 in.	19.0	20.6	18.4	25.0	24.4
Tube fittings, etc.	0.4	0.4	0.4	0.4	0.4
Tyres, wheels, axles	4.5	2.4	3.0	2.2	2.8
Forgings (excl. drop)	2.6	2.1	2.0	2.2	2.2
Steel castings ..	4.2	3.6	3.7	4.5	4.3
Tool steel	0.2	0.2	0.2	0.2	0.2
Total	300.5	312.0	287.8	394.2	397.1
Alloy Steel	16.1	18.2	17.0	23.8	23.1
Total deliveries from UK production[6] ..	316.6	330.2	304.8	418.0	420.2
Add: Imported finished steel ..	7.0	7.1	6.3	15.6	15.2
	323.6	337.3	311.1	433.6	435.4
Deduct: Intra-industry conversion[7] ..	41.2	47.6	46.0	60.1	60.6
Total new material ..	282.4	289.7	265.1	373.5	374.8

TABLE 4.—*Production of Pig-iron and Ferro-alloys*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derbys, Leics, Notts, Northants, and Essex	21	—	30.7	22.0	0.1	—	52.8
Lancashire (excl. N.-W. Coast), Denbigh, Flints, and Cheshire ..	8	—	22.6	—	—	1.8	24.4
Yorkshire (excl. N.-E. Coast and Sheffield) ..	—	—	—	—	—	—	—
Lincolnshire ..	8	—	44.8	—	—	—	44.8
North-East Coast ..	17	2.1	59.8	—	—	1.4	63.3
Scotland	7	1.6	22.9	1.3	—	—	25.8
Staffs, Shrops, Worcs, and Warwicks ..	4	—	7.6	1.0	—	—	8.6
South Wales and Monmouthshire	11	2.5	60.7	1.5	—	—	64.7
Sheffield	2	—	3.4	—	—	—	3.4
North-West Coast	8	20.2	—	2.1	—	0.5	22.8
Total ..	86	26.4	252.5	27.9	0.1	3.7	310.6
March, 1960[4] ..	87	26.0	257.2	24.9	0.1	4.1	312.3
April, 1959 ..	79	20.4	189.3	18.5	0.2	2.9	231.3

[1] Used in non-food manufacturing industries.

[2] Weekly average of calendar month.

[3] Stocks, mainly ingots and semi-finished, at the end of the year and months shown.

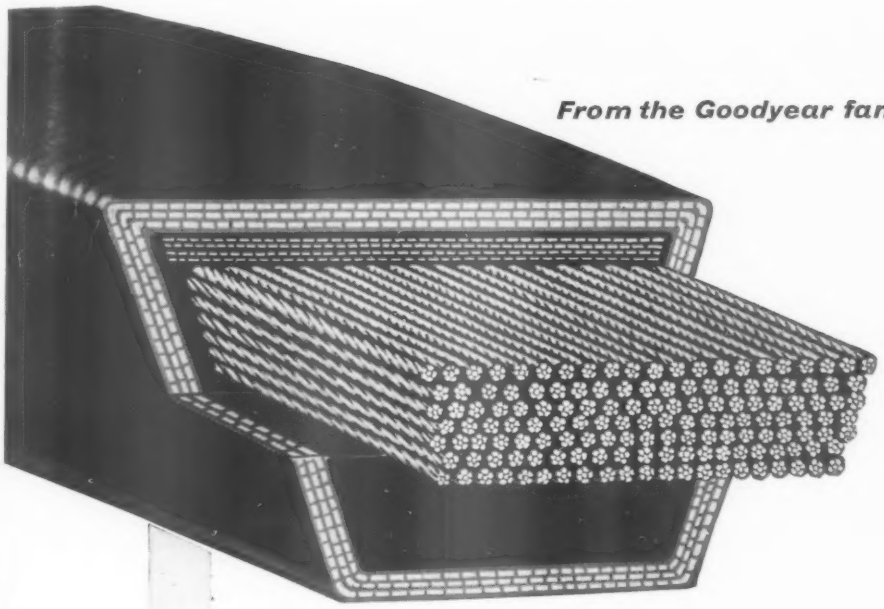
[4] Five weeks, all tables.

[5] Other than for conversion into any other form of finished steel listed.

[6] Includes finished steel produced in the UK from imported ingots and semi-finished steel.

[7] Material for conversion into other products also listed in this table.

From the Goodyear family tree



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Raw Material Markets

Iron and Steel

Most of the ironfoundries are able to maintain output at recent levels, the exception being the light foundries which supply castings to the domestic utensil trade and where demand has fallen off appreciably. There is some redundancy and short-time working at one or two of the foundries concerned.

The building trades continue to call for fairly good quantities of light castings and the jobbing and textile foundries are also fairly well employed. However, there is plenty of room for improvement as capacity is not being fully used.

The engineering and speciality foundries are, comparatively, employed at much better levels than other sections of the trade, the busier still being those supplying castings to the motor vehicle trade. The machine tool industry is also calling for larger quantities of castings, and only the collieries and railways show no signs of any appreciable increase in demands.

All the foundries are able to obtain all the pig-iron and other raw materials they need without difficulty, and only the shortage of suitable labour prevents many plants from increasing their output.

Pig-iron in all grades is plentiful and producers are able to cope with present demands without difficulty, in fact deliveries could be increased if required. This also applies to the low phosphorus irons, some brands of which are now more plentiful. The scrap supply position is also satisfactory. Deliveries of foundry coke are up to requirements and ganister, limestone, and firebricks are readily available.

Many of the re-rollers are now much better off for supplies of steel semis, and especially in the Birmingham and Staffordshire areas recent deliveries of imported billets have relieved the supply position considerably, particularly as the consignments from abroad include 2-in. small billets which are not easily obtained from home steelworks.

The re-rollers have satisfactory order-books for all their products, and good demand continues for small bars, light sections, and reinforcing rods, although some reports indicate that these are not now so heavy as they were.

Non-ferrous Metals

The more hopeful turn of events in the Congo has been a prime factor in turning the London copper market easier. The increased Bank rate has been an adverse factor, while irregular market conditions in New York have not helped. On top of this there is a report that copper is accumulating on the Continent, so that the Liverpool dock strike has not made much impact on the market.

The US price structure for both producers and custom smelters is unchanged at 33 cents a pound, although the custom smelters' buying price for scrap has been increased to 25 cents a pound. The outlook, however, is not clear.

After a month of secret negotiations the draft of the new International Tin Agreement, which is to come into force next year, was unanimously approved at the United Nations Tin Conference at the end of last week. In general terms, there are no surprises, the main point emerging being the fixing of the tin buffer stock at a maximum 20,000 tons, instead of 25,000 tons as in the present agreement. The other point is that Bolivia's share of the export quota in terms of percentages is being reduced from 19.4 to 18 per cent. and that of all the other countries increased accordingly.

The US and Russia continue to remain outside the agreement, but Japan and western Germany have decided to join the new agreement which will run for five years from July 1, 1961. However, before it comes into force the agreement has to be ratified by at least 15 member countries of which not less than nine must be consumers. The next meeting of the ITC will be held in London on August 25.

In London the market has been patchy since the rise in the bank rate, although continental interest has revived somewhat. In New York the market is reasonably good and the price not far short of $1.02 per pound.

With regard to lead and zinc, proponents of greater protection for US lead and zinc producers are trying to effect legislation in Congress which would institute additional tariffs if prices fell below 13½ cents a pound for lead and 12½ cents a pound for zinc.

Lead in London continues dull. One of the more depressing facts that have come to hand has been that consumption in the UK between March and April shows a drop of 7,000 tons as well as a fairly sharp increase in imports during the same period. There is now less talk of foreign metal reaching the UK. Even so, the price is now not far above £70 a ton. In New York the market is also dull and the price is unchanged at 12 cents a pound.

Zinc in London is not receiving much support and prices are tending to drift and are now around £90 a ton. In the US the market is featureless with the price at 13 cents a pound.

Russians Visit Refractories Works

A party of six Russian refractories technologists paid a visit to the basic-brick works and central research laboratories of General Refractories, Limited, at the Worksop works on Wednesday, June 22. At the conclusion of their visit the team was entertained to luncheon by directors and officials of the company. The Russian team consisted of: Mr. K. Strelov, director, Eastern Institute of Refractory Materials; Madame Repenko, chief engineer, Ukrainian Institute of Refractories; Mr. A. Panarin, director, Magnesite Refractories at Satka; Mr. A. Viasovov, director, Research Institute of Natural Salts, Leningrad; Mr. S. Bovkuw, director of Silica Brick Refractories, and Mrs. Lobova, interpreter. The visit was part of a tour of refractories plants in Britain organized by the Refractories Association of Great Britain. A reciprocal visit by members of the Association to Russia has been arranged and will take place in July.

THE LATEST *Newsletter* received from the Birmingham Engineering Centre (Stevenson Place, Birmingham 2) contains the following notices under "Capacity Wanted":—

Castings—Relay Yokes (32016), London. A large firm in the electrical field require capacity for the production of small castings. The products are yokes for relays, and after machining must have a nickel-plated finish; quantity 50,000 at 1,500 per week.

Castings, Meehanite (31994), Scotland. Glasgow firm seek foundry capacity for small Meehanite castings.

THE 13TH LIEGE INTERNATIONAL FAIR, Belgium, is to be held in June 1961.

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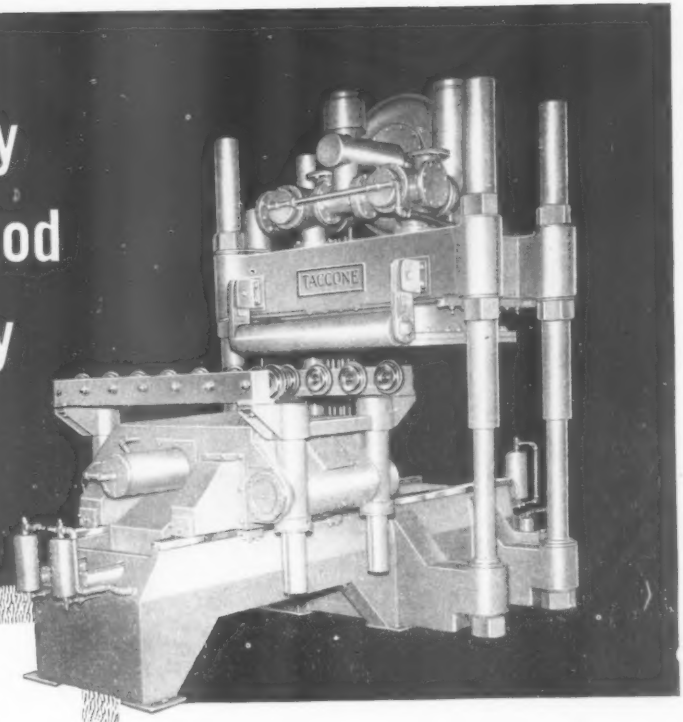

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TEL: JARROW 897124

BP/F1

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

June 29, 1960

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 7s. 6d.; Birmingham, £25 14s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £42 10s. 0d. to £44 10s. 0d., basis 15s. 0d. per unit, lumpy; 75 per cent. Si, £57 15s. 0d. to £61 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 20s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 12s. 1d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 15s. 1d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £80 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr. scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent, C,* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 10½d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 9 6/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £61 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections (1 ton to 10 tons).—Ship plates (N.-E. Coast), £41 12s. 0d.; boiler plates (N.-E. Coast), £44 2s. 0d.; floor plates (N.-E. Coast), £43 10s. 0d.; angles (N.-E. Coast), £38 16s. 6d.; joists (N.-E. Coast), £38 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in. and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £67 17s. 0d.; nickel-chrome, £98 11s. 0d.; nickel-chrome-molybdenum £111 4s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £249 0s. 0d. to £249 10s. 0d.; three months, £243 0s. 0d. to £243 10s. 0d.; settlement, £249 10s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 5½d. per lb.; rods, 270s. 0d. per cwt. basis; 20 s.w.g., 305s. 0d. per cwt.

Tin.—Cash, £799 0s. 0d. to £800 0s. 0d.; three months, £791 0s. 0d. to £791 10s. 0d.; settlement, £800 0s. 0d.

Lead (Refined Pig).—Second half June, £70 15s. 0d. to £70 17s. 6d.; second half September, £72 0s. 0d. to £72 5s. 0d.

Zinc.—Second half June, £90 10s. 0d. to £90 15s. 0d.; second half September, £89 15s. 0d. to £90 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £126 10s. 0d.; rolled zinc (boiler plates), all English destinations, £124 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £105 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 0½d. per lb.; sheets to 10 w.g., 222s. 6d. per cwt.; wire, 2s. 10½d.; rolled metal, 222s. 6d. per cwt.

Brass (Brazing).—BS1400, B3, £177; B6, £227.

Brass (High Tensile).—BS1400, HTB1, £204; HTB2, £224; HTB3, £237.

Gunmetal.—BS1400, LG2, £224; LG3, £233; G1, 1% £288; G1, 1%, £275.

Phosphor Bronze.—BS1400, PB1 (AID released), £318; BS1400, 90/10/1, £303.

Leaded Phosphor Bronze.—BS1400, LPB1, £244.

Phosphor Bronze Strip, etc.—Strip, 312s. 0d. per cwt.; wire, 4s. 3½d. per lb.; rods, 3s. 6d.; tubes, 3s. 6d.; chill cast bars, solids 3s. 5½d.; cored 3s. 6½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide x 0.056, 4s. 0d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb; Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £70 0s. 0d. to £70 10s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £263, AB2, £270.

* Average 68-70 per cent.

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Book Reviews

Chemical Analysis of Cast Iron and Foundry Materials. by W. Westwood and A. Mayer. (Revised edition by W. E. Clarke and H. Green.) Published by George Allen & Unwin, Limited, 40, Museum Street, London, W.C.1; price 63s. net.

Since the publication of the first edition of "Westwood & Mayer" the stature of this book has steadily grown and has become a welcome and familiar work of reference to the majority of metallurgical chemists engaged in the practical analysis of cast iron, ferro-alloys, ores, slags and refractories, etc.

The subject of this present review is a first revision of the original work and has been admirably performed with the intentions of bringing to light some of the more recent advances in analytical methods and techniques as a result of specialist experience and knowledge gained by the analytical staff of the British Cast Iron Research Association.

The introduction to the second edition has been enlarged from the original to include a referenced review of new separating techniques, based on solvent extraction, and a useful survey of instrumentation embracing spectrophotometry, flame photometry, polarography and X-ray fluorescence spectroscopy. Ion exchange and chromatography are mentioned briefly, these techniques being claimed by the reviewers to be of little practical value in ferrous analysis. Section two deals with sampling technique and the analytical methods recommended for determining the elemental constituents of cast iron. A notable inclusion here is the estimation of magnesium in nodular-graphite cast iron, either gravimetrically or by titration with E.D.T.A. Three alternative methods for magnesium are reviewed. New procedures are given for determining aluminium, antimony, lead, phosphorus and vanadium, and the original volumetric method for boron has been modified and improved. Further modifications of the methods for sulphur, titanium and cerium are included. Section three describes the sampling and analysis of ferro-alloys, inoculants and ladle alloying additions, and here the analysis of alloys such as nickel/magnesium, nickel/cerium/magnesium and copper/magnesium is freshly treated. Section four, dealing with iron ore, remains substantially similar to the original. Cupola slag, rotary-furnace slag, and blast-furnace slag are dealt with in section five, which proposes a new and attractive scheme for the more rapid analysis of these materials, avoiding many of the tedious classical methods previously recommended. It is claimed that a complete slag analysis can be carried out without loss of accuracy in less than one working day using the new procedure. Section six describes the treatment of refractories while the analysis of coke dealt with in section seven has been modified in accordance with current British Standard recommendations. The final sections, eight and nine, embrace the techniques for dealing with coal-dust and linseed oil respectively.

The general layout of the individual sections and detailed description of the methods remain largely unaltered from the first edition. The procedure for each element is accompanied by a theoretical discussion of the recommended methods and by a series of notes that provide many practical "tips" to those who may be performing the determination for the first time. The text contains abundant references and has been brought up to date. The series of appendices at the end of the book provide a wealth of useful information covering a range of matters including furnace construction, pyrometry, reagents and indicators, and data relating to composition of materials, British Chemical Standards, bibliographic references, etc.

The fundamental value of this excellent and authoritative treatise lies in its detailed instruction in analytical method and practice. It will undoubtedly be of invaluable assistance to any metallurgical chemist engaged in the practical analysis of cast iron and related materials. This revised edition is to be strongly recommended to all as probably the most up-to-date work of its kind in the particular field for which it is intended and there is little doubt that it will meet with similar, if not greater success than was gained by its predecessor over the past nine years.

S. CROSS.

Lloyd's Register of Shipping, 1760-1960, by George Blake. Published by Lloyd's Register of Shipping, 71, Fenchurch Street, London, E.C.3; price £2 2s.

This book, which is about ships, has been prepared for an organization devoted to the task of ensuring that maritime travel is as safe as human endeavour can make it. It is a *sine qua non* that any book dealing with ships must cover history, and the author has given many interesting sidelights on national and international events during the last 200 years. Bessemer's invention, the development of welding, the steam engine, and Parson's turbines all had a profound impact on shipping, probably to a greater extent than world wars.

Obviously, the author's main task was to relate the history of Lloyd's Register of Shipping. It makes a story showing (especially in the last few decades) that continuous progress has been made. In contrast, in the very early days, some narrow mindedness and not a little high-handedness were shown in the running of the affairs of the concern. In those days, quite often an individual, in expressing his view, failed to realize the wider interests involved.

Though covering technical subjects, Mr. Blake writes so well that his material can be easily understood and appreciated by any sixth-former. People interested in ships and shipping and in history over the last 200 years will find this book completely absorbing.

V. C. FAULKNER.

The Allen West Story. Published for private circulation by Allen West & Company, Limited, Brighton.

This book has been produced as part of the golden-jubilee celebrations of Allen West & Company, Limited, the well-known firm of makers of electric control gear. Most of the older generation will remember the days of riding in tram-cars when the driver made constant movements with Allen West control gear. The year 1910 was a good year for starting up an engineering business, as within four years the war gave a great impetus to manufacturing enterprises—especially to those which were adaptable to new ideas. The progress shown by the Allen West concern, which started in a rented portion of a factory at Brighton, is indeed remarkable, as the company now has subsidiary companies in South Africa, Canada, Rhodesia and an associated company in France. It is a great exporting concern and in 1958 sold nearly £1,000,000 of electric-motor equipment or just under a third of Britain's total for this commodity. The company now employs several thousands of workpeople and the book tells of the special efforts it makes to train the younger generation. (To the management, the JOURNAL adds its congratulations to the great many they must have received on the great progress achieved.)

Mr. A. T. STAFFORD, works manager of John King & Son (Enamellers), Limited, vitreous enamellers, Pyro Works, Whittington Moor, Chesterfield, died suddenly on June 13.

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Publications Received

Chemical Analysis of Silica Sands, by H. D. Segrove, M.Sc.(Tech.), F.R.I.C. Published by British Industrial Sand Company, Limited, Holmethorpe, Redhill, Surrey.

Presented in a stiff black binding, this specialized work on proved methods for the chemical analyses of silica sands will be welcomed in all foundry laboratories. It opens with some notes on sampling—a primary requisite for the ensuring of correct results. Then, in 16 pages, methods are given for the determination of silica, alumina, ferric-oxide, manganous-oxide, titania, zirconia, chromic-oxide, magnesia, calcium-oxides and alkalies. The reviewer is in no position to criticise the methods advocated, as they are quite different from those "in vogue" when he was young, but presuming—and the presumption is well-founded—they are correct, this book is a valuable addition to any laboratory charged with the control of sands.

Annual Report 1959. Published by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

The 1959 Annual Report of the Federation is quite an optimistic one, the steel industry being stimulated no doubt by the passing of the threat of re-nationalization and the trade recession. The president of the Federation, Mr. R. F. Summers, forecasts that this year, pig-iron production should reach 16,000,000 tons and the steel output should exceed 24,000,000 tons, both record figures. He also states that despite the impact of the recession, capital expenditure in each of the years 1958 and 1959 was running at a rate of about £100,000,000 and, this year, it is expected that the figure will be 25 per cent. more. In steelmaking, increasing use of pneumatic processes, and electric furnaces is forecast, and oxygen is predicted as one of the primary steelmaking raw materials.

House Organs

The Forge, Vol. 10—Journal of the Brockhouse Organization. Published by J. Brockhouse & Company, Limited, 25, Hanover Square, London, W.1.

Those readers interested in foundry practice will find the article "How Moulding Techniques combine Age-old Craftsmanship with Modern Methods" very interesting, as it carries a description of the steel foundry of Brockhouse Castings, Limited, at Wednesfield. The equipment includes three 30-cwt. converters and five cupolas, one of which is a hot-blast cupola which reduces sulphur in the metal required for conversion into steel. Good use is made of roller conveyors and the article describes the production of castings from the first drawings made, through the various stages of preparation of the mould, pouring, knocking-out, fettling, and inspection.

Hawker Siddeley Technical Journal, Vol. 1, No. 4. Published from 18, St. James's Square, London, S.W.1.

Contained in this issue is an article of real interest to steelfounders. It is entitled "Hot-tears in Steel Castings," and is written by Mr. Michael A. Notte, foundry engineer of Canadian Steel Foundries, Limited. Experienced foundrymen will find interest in comparing the design recommendations set out in Fig. 1 of the article with those given in the recommendations (of French origin) contained in the booklet a "Practical Guide to the Design of Steel Castings." The author gives some useful and interesting "wrinkles" which are new to the reviewer. Other articles in this issue cover high-speed diesel engines, heat-treatment of aluminium-alloy forgings, transformers, and operational and economic studies for industry.

Power-Gas Group Review No. 9. London office: 39, Victoria Street, London, S.W.1.

This well-produced house organ contains articles on "Recovery of Sulphur from Hydrogen Sulphide," by Mr. J. C. Melbourne, and "Gartsherrie—Scotland's New Foundry Iron Plant," by Mr. B. S. Fowler. The latter article, whilst giving an excellent technical description, does not tell readers either the composition of the pig-iron to be made or the quantity of iron the new plant will produce. However, as Gartsherrie was noted for its foundry pig-iron, it can be presumed that the traditional quality will be the objective of the new plant.

Newsletter, Vol. 12, No. 2. Published by the David Brown group of companies.

This issue announces important extensions to the group's Penistone foundry. These include a new building to house gamma-ray inspection equipment so that medium and large castings can be handled simultaneously in separate compartments; the building of a large gas-fired heat-treatment furnace having an 11-ft. 6-in. by 18-ft. hearth. (This new plant will include fully-automatic recorders and controllers.) The third project is concerned with the manufacture of complete pump units at Penistone.

Butterley Foundry News, Vol. 1, No. 4. Issued by the Butterley Company, Limited, Ripley, Derbyshire.

This issue gives an excellent illustrated description of the moulding of a still body weighing 10 tons. The castings for this are 8-ft. 3-in. i.d. and 6-ft. 6-in. deep and are cast in "CB" Meehanite and the still produced is for sulphuric acid. The brochure also details a group of Meehanite nodular cast irons. Six types are listed and a table gives their mechanical properties. Other articles feature the company's Tripedal unit system of iron paving and a range of small castings regularly manufactured.

Aluminium Courier, No. 48. Published by the Aluminium Development Association, 33, Grosvenor Street, London, W.1.

Most of this issue is devoted to the use of aluminium in the fishing industry and discloses the use of this metal to replace wood and steel. An echo-sounding recorder for detecting fish is illustrated, the outer case of which is an LM 6 gravity-die-casting. However, most of the components used in the industry are in wrought form.

A.E.I. Engineering Review, Vol. 1, No. 1. Published by Associated Electrical Industries, Limited, 33, Grosvenor Place, London, S.W.1.

This new magazine is of an interim character and replaces four well-established house organs—BTH Activities, M-V Gazette, Siemens Edison Swan Journal and Henley's Distribution of Electricity. The new journal is of a high standard and covers the technical activities of the whole group in a very interesting way.

Nickel Bulletin, Vol. 33, No. 3. Issued by the Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1.

This issue contains a review of an interesting article on the welding of s.-g. iron. It concludes with a plea for more research in the following fields: (1) Elimination of the hard (carbidic) heat-affected zone; (2) better reproducibility of results, and (3) development of low-cost (preferably automatic) welding methods.

LSR 41 Grinder at work on a heavy casting

COMPRESSED AIR for the FOUNDRY

Atlas Copco puts compressed air to work for industries of every class—light, medium and heavy. For foundry work there are Atlas Copco rammers, chipping hammers and grinders carefully balanced to reduce operator fatigue and ensure the best possible results. For example, rammers are designed to "walk" with a minimum of guidance, allowing the operators to give all their attention to tamping.

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Atlas Copco heavy duty grinders are easier, less tiring to use. They combine maximum power with minimum size and weight and are designed for the quietest possible operation. Special safety governors ensure constant speeds regardless of varying loads. These grinders open the way to increased output; with Atlas Copco R-type chipping hammers they form a range of robust, reliable tools for all types of fettling and dressing operations.

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With companies or agents in ninety countries, Atlas Copco is the largest organisation in the world specialising solely in compressed air equipment. Products include stationary compressors from (2.5 to 20,000 c.f.m.) ·08 to 566m³/m portable compressors, air tools, rock drills, loaders and paint-spraying equipment. Wherever you are, the international Atlas Copco group offers expert advice and provides a complete after-sales service.

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This catalogue presents a selection of Atlas Copco Equipment for industry (including the foundry trade). Write for a copy to your local Atlas Copco company or agent or to the address below.

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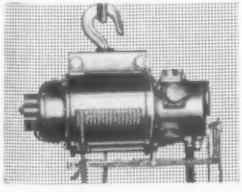
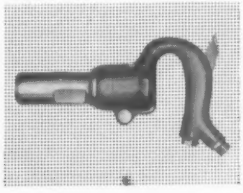
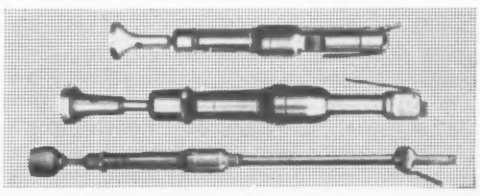


R3B Chipping Hammer



3 Rammers from the Atlas Copco range STR3



CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

TECHNICAL REPRESENTATIVE with foundry experience wishes to represent a Foundry for cast-iron and non-ferrous castings. Has personal connections in London and Home Counties. Part expenses and commission. Box TR699, FOUNDRY TRADE JOURNAL.

SALES MANAGER, energetic, adaptable, wide practical experience all aspects iron founding, requires situation with really live firm. Present connections general engineering, mainly Midlands. Box SM708, FOUNDRY TRADE JOURNAL.

TECHNICAL REPRESENTATIVE, age 33, connections in the south, seeks position with reputable foundry. Box TR714, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

FOUNDRY MANAGER for Iron and Non-ferrous Jobbing Foundry, Birmingham Area, with capacity up to 30 tons per week.

Applicant should be between the ages of 35 and 45 and should have had previous experience in management relating to supervision of labour, ratefixing, estimating, quality control, development of modern methods, production and cost control, for which he will be responsible.

Preference will be given to applicant with working experience of the district.

Salary according to experience. The Company operates an attractive contributory Pension Scheme. Assistance with house purchase if required. Box FM696, FOUNDRY TRADE JOURNAL.

ASSISTANT MELTING SHOP MANAGER

A.P.V.-PARAMOUNT LIMITED wish to make this new executive appointment prior to the coming into operation this Autumn of major extensions to the furnace plant serving their Crawley steel foundries.

Applicants must have had either high frequency or arc melting experience, preferably with previous laboratory training and be 25/35 years of age.

The appointment offers attractive starting salary, with due recognition given to any technical qualification, and provides above average scope for the future for an individual of ability. The appointment is permanent and pensionable, and provides excellent working and living conditions in the South of England, where assistance with housing can be given.

Applications to the Personnel Manager,
A.P.V.- PARAMOUNT LIMITED,
Manor Royal, Crawley, Sussex.

SITUATIONS VACANT—*contd.*

FOUNDRY FOREMAN required, must be fully experienced Moulder in Grey Iron Castings, and able to train labour in general jobbing and semi-mechanical plant. Only fully experienced men able to take complete charge need apply, stating salary required, and when free to start. The position offers great scope and the opportunity of advancement to Foundry Manager. Box FF711, FOUNDRY TRADE JOURNAL.

ASSISTANT FOREMAN required for moulding section of whiteheart malleable foundry. Applicant should be a practical man with some experience of snap-flask or pin-lift machines. Age 25-35. Sports club and canteen. Pension Scheme. Write giving details of previous experience and present salary to:

BAGSHAWE & CO., LTD.,
Dunstable, Beds.

FIRST HAND STEEL MELTER required for 2-ton Electric Arc Furnace, foundry situated in the South of England. Applicants should state full details of experience, age and salary required, to Box FN690, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for Grey Iron Jobbing Foundry in North Manchester area. Weekly production 5 tons. Practical man with experience of plate and loose pattern work, sand and metal control essential. State age and experience. Box FM700, FOUNDRY TRADE JOURNAL.

[STEWARTS AND LLOYDS, LIMITED]
require a
MOULDING SHOP SUPERINTENDENT

TO take Charge of Moulding, Coremaking and Sand Preparation Departments at their TOLLCROSS STEEL FOUNDRY, near GLASGOW.

Applicants should have a thorough practical knowledge of modern steel foundry practice including air-set oils, and should preferably have worked with both alloy and plain carbon steel castings in the weight range 1 to 6 tons.

Written applications giving full details of education, qualifications, experience and age, should be sent to MANAGER, PERSONNEL SERVICES, Clyde Office, Coatbridge.

SITUATIONS VACANT—*contd.*

CASTER required for pouring brass and gunmetal. Top wages and bonus. House provided for suitable man. Midlands area. Box CR707, FOUNDRY TRADE JOURNAL.

ENERGETIC FOUNDRYMAN required to develop new small machine moulding section, to produce pressure-tight gunmetal castings. Must be able to train labour. Apply HAVEN DIE CASTING LTD., Railway Road, Newhaven, Sussex.

WELL-KNOWN
FOUNDRY SUPPLY ORGANISATION
HAS A VACANCY FOR A
REPRESENTATIVE IN SCOTLAND

APPLICANTS should have a good knowledge of the Foundry Industry, preferably coupled with selling experience. After an initial period of training the successful applicant will take over an established territory in Scotland. Opportunities for promotion from this position are good and only candidates of proven ability and good personality need apply. Box WK705, FOUNDRY TRADE JOURNAL.

A GENERAL WORKS MANAGER

is required to supervise the production of a group of foundries in Yorkshire employing approximately 1,000 personnel. The position will be suitably remunerated, including a pension scheme together with car and assistance in housing accommodation. Applicants must have experience of modern methods of production preferably in the steel casting industry and previous experience in a managerial capacity is essential. Comprehensive details of technical education and experience to date should be sent in complete confidence to The Managing Director,

Box No. AG 710.

FOUNDRY TRADE JOURNAL

BRASS FOUNDRY FOREMAN

Required for Non-ferrous Foundry in Birmingham. Applicant must have practical and Supervisory experience in semi-mechanised production. Excellent prospects for suitable applicant.

Write giving full details to :—

PERSONNEL MANAGER,
BOX No. BF 693.
Foundry Trade Journal

QUALCAST LIMITED

Require Core Shop Superintendent. Experience in mass production of Small Cores for Automobile Castings and similar by Core Blowing Machines. CO2 Process and Shell is essential. This position carries an attractive Salary and Bonus. Existing holiday arrangements will be honoured. *Write in confidence giving full details to*

WORKS MANAGEMENT
VICTORY ROAD, DERBY

SITUATIONS VACANT—*contd.*

A YOUNG DESIGN DRAUGHTSMAN is required to develop schemes for Foundry Mechanisation. Applicants must have a wide knowledge of the design of Sand Handling Equipment and be capable of working with the minimum of supervision. Write, stating full details of experience and salary required, to THE SECRETARY, Foundry Plant Division, Richards Structural Steel Co., Ltd., Leicester.

A FIRST CLASS Scottish Steel Foundry producing castings up to 10 tons weight each, requires a REPRESENTATIVE to cover the Midlands and North of England. Applicants would need to be resident in the area, and should give full particulars of age, education, experience and salary required, also present position and salary. Car provided, expenses paid, pension scheme. Box AF689, FOUNDRY TRADE JOURNAL.

MOULDERS—Skilled General Iron Moulders required, used to high class engineering work. Piecework earnings £20/£23 for good men. Smethwick/Oldbury district. Apply Box MS695, FOUNDRY TRADE JOURNAL.

CUPOLA CHARGEHAND (working) required by well equipped modern foundry, age 25-35 years. The suitable applicant must be experienced on cold-blast Cupola producing 10/17 tons per hour. A knowledge of calculating metal charges, etc., would be an advantage, but this is not essential. Staff status would be considered to a suitable applicant after a probationary period. Canteen and welfare facilities.

Application in writing only, together with full particulars of past experience and salary required, to:

BILSTON FOUNDRIES LIMITED, Highfields, Bilston.

GRAVITY DIECASTERS, aluminium or brass. Aluminium and Non-ferrous Sand Moulders. On coast between Brighton and Eastbourne. Details to R. F. LOCKYER, Haven Die Castings, Ltd., Newhaven, Sussex.

FOUNDRY FOR SALE

FOR SALE. Malleable Ironfoundry and Engineering Business, old established with good connections. Would consider partnership with firm able to bring foundry labour to make castings for their own requirements. Freehold property with room for expansion. For further information write Box MA717, FOUNDRY TRADE JOURNAL. Reason for sale, owners wish to retire. Opportunity for firm wanting additional works. Midlands.

BUSINESS OPPORTUNITIES

EXPERIENCED IMPORTER of British Foundry Equipment and Supplies looking for worthwhile items to add to the line he is presently importing from U.K. to U.S. Reply to Box EI670, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

PRESSURE DIE Casting Machines. Cold Chamber. Two or three wanted from approximately 4 oz.-10 oz. capacity. Box PD687, FOUNDRY TRADE JOURNAL.

SAND MILL from 42 in. to 5 ft. with a batch capacity from 3-4 cwt. Good condition. GROVE IRON WORKS, Bridport.

WANTED. 8 cwt./12 cwt. tup. Send full particulars to Box WA713, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED—*contd.*

WE REQUIRE one 4-ton per hour Cupola (45 in. dia. of shell) fitting with a suitable wet type dust arrestor. We also require the same cupola fitting with skip charging machine. Height to charging hole 16 ft. 4 in. Can you offer anything secondhand or alternatively quote for new. Box WR697, FOUNDRY TRADE JOURNAL.

MOULDING MACHINES

B.M.M. Types HPL1. and 2. Jackman Headpress Hand Squeeze, pin lift. Core Sand Mixers, 5-10 cwt. Box MM702, FOUNDRY TRADE JOURNAL.

WANTED. 50 Pairs of Steel Moulding Boxes. Size 16 in. × 16 in. × 5 in. each part. Apply: S. MOLE & SONS (G.L.F.) LTD., Bott Lane, Lye, Stourbridge.

MACHINERY FOR SALE

COLEMAN CA TYPE Abrasive Wheel Cut-off Machine for sale complete with spares and in as new condition. Standard voltage electrics. Box CO715, FOUNDRY TRADE JOURNAL.

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ONE BOOTH approx. 31 ft. 6 in. × 9 ft. 2 in. × 7 ft. 6 in. high. Manufactured from ¼ in. M.S. Plate and M.S. supporting beams.
One Set of Ductwork in 18G and 16G.
Ten 3,000 size H.E. Type Cyclones.
Ten Dust Receptacles.
One M.S. Supporting Structure for Cyclones.
Two No. 24 Axia Flow Fans.
For further details, write or phone:

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Telephone:—Leeds 27986.

600

ELECTRICALLY DRIVEN COMPRESSOR SETS FOR USE ON 400/440 VOLTS, 3 PHASE, 50 CYCLES.

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169 c.f.m. INGERSOLL RAND 100 p.s.i.
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Many others in stock would welcome your enquiries

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and STANNINGLEY nr. LEEDS
Tel: Pudsey 2241

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100 lbs. to 350 lbs. brass capacity new LIFT-OUT furnace from £92

100 lbs. to 400 lbs. aluminium capacity new BALE-OUT furnace from £112

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MACHINERY FOR SALE—*contd.*

MONOMETER SEMI-ROTARY FURNACE, 2-ton capacity. Used on gunmetal. Two burners. Inspection: WHITLEY PARTNERS, LTD., Hunslet Road, Leeds, 10.

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THREE MATHEWS & YATES "Cyclone" paddle blade fans, size PB8, duty 2,000/8,000 c.f.m., 12/7 in. water gauge.

GEORGE COHEN
SONS CO., LTD.
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Tel: Shepherds Bush 2070
and STANNINGLEY nr. LEEDS
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MOULDING MACHINES.

B.M.M. Jolt Squeeze Turnover: Types AT0, AT5.
B.M.M. Hand Squeeze Turnover Draw TO3, table 30 × 20.
Coleman-Wallwork Shockless Jolt Squeeze Patt. Draw, WT562a.
Adaptable: Standard and large sizes.
Britannia Hand Ram Pin Lift, 26 in. × 16 in., draw 8 in.
Britannia Pneumatic Jolt Lift, 22 in. × 26 in.
McNab Jolt Squeeze Patt. Draw, 16 in. × 14 in.
Also in stock: Sand Mills, Mixers, Fettling Grinders, Dust Collectors, Air Compressors, Blowing/Exhausting Fans, Core Drying Stoves, etc., etc.

S. C. BILSBY & CO.,
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Large stock of foundry Ladles. Capacities from 5 cwts. to 10 tons. Please send for list.

Pneulec 2-ton capacity Balanced Blast Cupola.

Three small Cupolettes.
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Spermolin 2-cwt. capacity motorised Sand Mixing Machine.

MacNab, jolt squeeze, moulding machine.

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New Polford 600 lb. capacity coke-fired furnace.

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Pneulec Sand Mixing Machine.

Large size Adaptable hand moulding machines.

Full details on request from:

ELECTROGENERATORS LTD.,
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Telephone: Slough 22877 & 22094

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SAND MIXERS and DISINTEGRATORS for Foundry and Quarry; capacities from 10 cwts. to 10 tons per hr.—W. & A. E. BERALEY (MACHINERY), LTD., Misterton, nr. Doncaster. Tel.: Misterton 203.

LARGE QUANTITY good quality Moulding Boxes, various sizes from 14 in. × 11 in. upwards to 4 ft., at very cheap prices. Inspection invited at SHAW & SMITH (DARLASTON), LTD., Woodsbank Terrace, Moxley, Darlaston, Staffs.

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LINSLADE No. 1 Automatic Sand Rammer, cap. approx. 600 lb. rammed sand per minute. Max. radius 10 ft. With electrics wound for 400/3/50 cycles supply.
New Guyson Shot Blast Cabinet, 42 in. × 30 in. × 36 in. Complete with Dust Collector and Extraction Unit. With electrics wound for 400/440/3/50 cycles supply.
Three secondhand Morris type "M" Screenerators, motorised for 400/3/50 cycles supply.
Wallwork Type 562AY Turnover Moulding Machine, load 300 lb., pattern draw 8 in., table size 22½ in. × 17½ in.
Coleman Wallwork type CN. Jolt Squeeze Ram Pattern Draw Moulding Machine, load 600 lb.; pattern draw 10 in., suitable for boxes 20 in. × 20 in. or 25 in. × 12 in.
Shot Blast Plant, Rumbling Barrels, Furnaces, Air Compressors, available from stock.

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ONE SPENCER AND HALSTEAD Shot Blast 6 ft. 6 in. × 6 ft. 6 in. Room. Complete with Bucket Elevator, Desilter and Dust Extraction. Can be seen working. Available mid-July. Box SP698, FOUNDRY TRADE JOURNAL.

HACKBRIDGE & HEWITTIC Indoor Type O.I. Transformer, 3/3 phase, 6,600/400 volts, 50 cycles, Delta-Star, 2,000 kVA rating. WHITEFIELD MACHINERY & PLANT, LIMITED, 48, Chatham Street, Edgeley, Stockport. Stockport 4471.

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SMALL NON-FERROUS FOUNDRY, N./Midlands, with capacity available, wishes to contact anyone who can introduce regular runs of castings on commission basis. Also Metal Polishing, Electro-Plating and Pattern Making facilities available. Box SN716, FOUNDRY TRADE JOURNAL.

CAPACITY AVAILABLE—contd.

VITREOUS ENAMELLING.—Capacity available for enamelling castings in all finishes (plain, mottle, marble, lustre, etc.). Prompt delivery by our own transport.—THE RUSTLESS IRON CO., LTD., Trico Works, Keighley, Yorks. Tel.: Keighley

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STEEL BUILDING, 90 ft. × 50 ft.—30 ft. to eaves, 37½ ft. to apex, new condition. Also a large quantity of Roller Track. SHAW & SMITH (DARLASTON), LTD., Woodsbank Terrace, Moxley, Darlaston, Staffs.

SPEEDY MOISTURE TESTING with "Speedy." Accurately gives the moisture content of foundry sand in 3 minutes. Fully portable; costs £27 10s. complete. Write for leaflet to: THOMAS ASHWORTH & CO., LTD., Dept. No. F.T.J., Burnley, Lancs.

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Discarded Sacks, Slag Bags, Old Sacking.
For good prices and prompt settlement sell to actual users.
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Wanted

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MATERIALS FOR SALE—*contd.*

CALCIUM SILICIDE. Finely ground Calcium Silicide—for nodular iron-exothermic compositions, etc. (now being successfully used by several foundries) at prices which save you money. TOXANE LIMITED, 47, High Street, Edgware, Middlesex. EDGware 6666.

FIREWOOD for Cupolas, Sleepers and Sleeper Wood in wagon loads.—TILLEY'S (WOLVERTON), LTD., Wolverton, Bucks.

MAY WE quote you for Spent Hop Manure. Regular supplies. Road deliveries. SMALLMAN, Oakham Road, Dudley 52818.

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HENRY CLUETT & CO.—Patterns of all types in Wood and Metal. Quotations by return. Quick delivery. Furlong Road, Tunstall, Stoke-on-Trent. Tel. 87822.

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PATTERNS for all branches of Engineering for Hand and Machine Moulding.—FURNESTON & LAWLOR, LTD., Letchworth.

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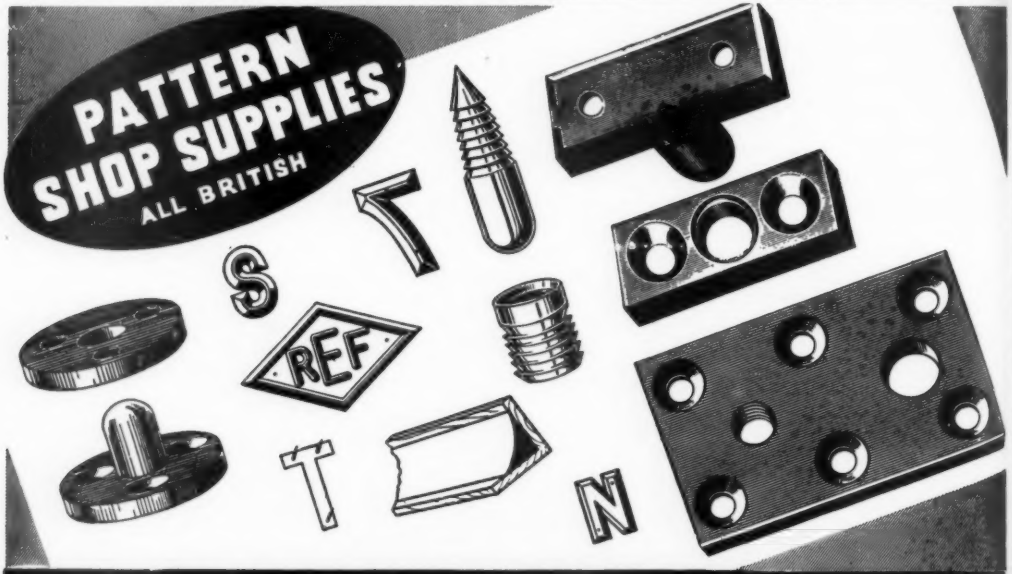

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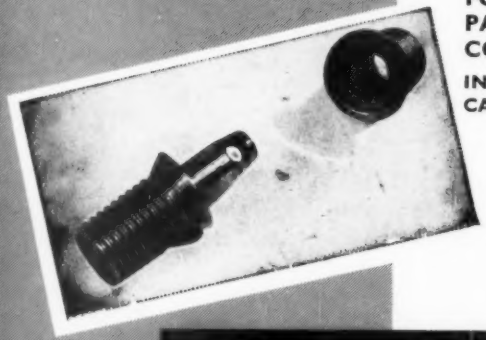

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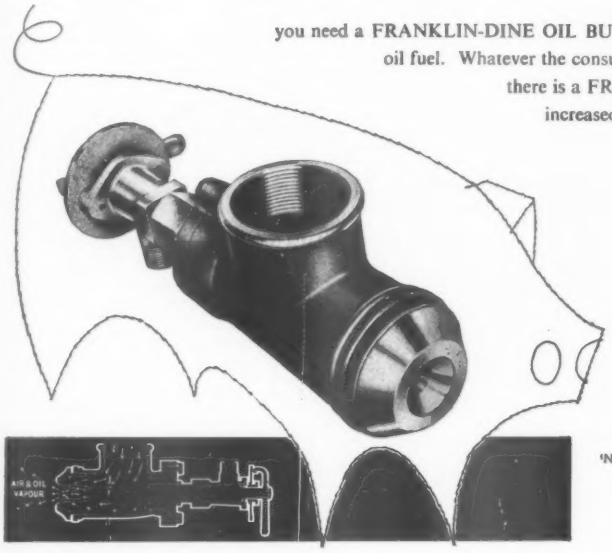

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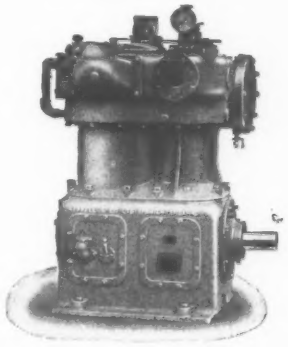

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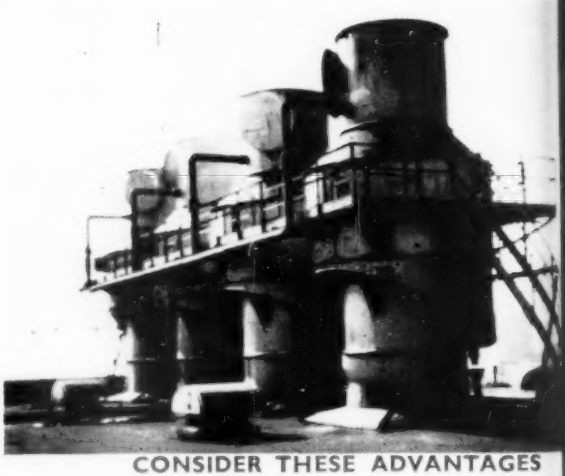

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